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#7

Serial Number: 10/056,295

Title: ASYMMETRIC DISK SURFACE PROPERTIES IN ONE HEAD DISK DRIVES

Attorney Docket Number: 3123-424 / 20011.03

TRANSMITTAL LETTER

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Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Enclosed are the following:

1. X Petition for Withdrawal of Final Restriction Requirement.
2. X Exhibits A through E.
3. X A check in the amount of $130.00.
4. X A return receipt postcard.

No new matter has been added.

March 2, 2004
Date

James P. Broder
Attorney for Applicant(s)
Reg. No. 43,514

CERTIFICATE OF MAILING UNDER 37 CFR §1.8

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JAMES P. BRODER, Attorney for Applicant--Registration No. 43,514

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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In re application of:	Schreck, et al.	
Serial No:	10/056,295	Art Unit 2652
Filed:	January 23, 2002	
For:	ASYMMETRIC DISK SURFACE PROPERTIES IN ONE HEAD DISK DRIVES	
Examiner:	Klimowicz, William J.	
Attorney Docket:	3123-424 / 20011.03	

PETITION PURSUANT TO 37 CFR § 1.181
FOR WITHDRAWAL OF FINAL RESTRICTION REQUIREMENT

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Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the final decision of the Examiner requiring restriction, the Applicants hereby respectfully submit the following Petition pursuant to 37 CFR § 1.181 for Withdrawal of the Final Restriction Requirement. If the instant Petition is granted, the Applicants respectfully request that claims 8, 9, 11, 12, 17, 19-22, 25-30, 37, 38, 42, 43, 47, 49-51 and 54-58 be examined concurrently with claims 2, 4-7, 10, 14-16, 18, 23, 24, 31, 33, 35, 36, 39-41, 44-46, 48, 52, 53, 59, 60.

CERTIFICATE OF MAILING UNDER 37 CFR §1.8

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail, postage prepaid, in an envelope addressed to: Mail Stop Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this the 2nd day of March, 2004.

JAMES P. BRODER, Attorney for Applicant--Registration No. 43,514

03/10/2004 AWONDAF1 00000034 10056295
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I.

Introduction

MPEP 1002(c) and 37 CFR § 1.144 provide the authority for patent applicants to petition the Commissioner (pursuant to 37 CFR § 1.181) to review a final requirement for restriction. The Petition may be deferred until after final action on or allowance of claims to the invention elected, but must be filed not later than appeal. 37 CFR § 1.144.

II.

Statement of Facts

The present Non-provisional Application (hereinafter the "Non-provisional Application") was filed on January 23, 2002. (A true and accurate copy of the Non-provisional Application is attached hereto as Exhibit "A"). The Non-provisional Application claimed priority on Provisional Application Serial No. 60/298,969, filed on June 18, 2001. Each of the claims in the Non-provisional Application is directed toward either an asymmetrical storage disk, a disk drive that includes an asymmetrical storage disk, a method for making a disk drive that includes an asymmetrical storage disk, or a method for manufacturing an asymmetrical storage disk.

On October 9, 2003, the Examiner mailed a Restriction Requirement (hereinafter "Restriction Requirement"), requiring an election among two groups, twelve Species and three Subspecies of claims. (A true and accurate copy of the Restriction Requirement is attached hereto as Exhibit "B"). As set forth in the Restriction Requirement, the Examiner determined that the "application contains claims directed to the following patentably distinct species of the claimed invention: (I) Figures 2C, 2D drawn to an asymmetrical disk

having radially disposed stiffening members, (II) Figure 2E drawn to an asymmetrical disk having stiffening members disposed on a second side and having layers coating the second side, such that the second side is substantially flat, (III) Figures 2F-2I drawn to an asymmetrical disk having a completely flat side, with no radially disposed projecting members, (IV) Figure 3A drawn to an asymmetrical disk having concentrically spaced tubular-shaped stiffening members, (V) Figure 3B drawn to an asymmetrical disk having spiral-shaped stiffening members, (VI) Figure 3C drawn to an asymmetrical disk having arc-shaped stiffening members, (VII) Figure 4A drawn to an asymmetrical disk having a damping layer, (VIII) Figure 4B drawn to an asymmetrical disk having a damping layer and a constraining layer, (IX) Figure 5A, 5B drawn to an asymmetrical disk having a plurality of projections, (X) Figure 6 drawn to an asymmetrical disk having a balance modifying supplemental layer, (XI) Figure 7A drawn to an asymmetrical disk having an adsorption layer, and (XII) Figure 7B drawn to an asymmetrical disk having an adsorption layer and a diffusion layer."

The Applicants subsequently timely filed a Response to Restriction Requirement (hereinafter "Response to Restriction") on November 6, 2003, in which the Applicants elected, with traverse, the claims of Group II, Species VI and Subspecies A, comprising at least claims 1-10, 13-16, 18, 23-24, 31-41, 43, 46, 48, 52-53, 59-68 and 70. (A true and accurate copy of the Response to Restriction is attached hereto as Exhibit "C"). In the Response to Restriction, the Applicants requested reconsideration of the Examiner's Restriction Requirement. Further, the Applicants stated that at least claims 1-4, 6-7, 9, 31-33, 35-36, 38, 59-63, 65-66 and 68 were generic claims which read on Species I-XII. The Applicants also asserted that all claims read on each of the three different Subspecies.

On December 2, 2003, the Examiner mailed a Non-final Office Action (hereinafter "Office Action") that upheld the Restriction Requirement and found the Response to Restriction to be non-persuasive. (A true and accurate copy of the Office Action is attached hereto as Exhibit "D"). The Examiner stated in the Office Action that claims 8, 9, 13, 37, 38, 43, 67 and 68, which the Applicants indicated to be readable on the elected invention were directed to a non-elected invention. Further, the Examiner withdrew claims 8, 9, 11-13, 17, 19-22, 25-30, 37, 38, 42, 43, 47, 49-51, 54-58, 67-69 and 71-80 from consideration. Thus, only claims 1-7, 10, 14-16, 18, 23, 24, 31-36, 39-41, 44-46, 48, 52, 53, 59-66 and 70 have been examined on the merits.

The Applicants have filed with the Patent Office concurrently herewith an Amendment and Response to Office Action (hereinafter "Response to Office Action"). (A true and accurate copy of the Response to Office Action is attached hereto as Exhibit "E"). In Exhibit "E", the Applicants have canceled claims 1, 3, 13, 32, 34 and 61-80, and have added claims 81-106. Consequently, the subject of the instant Petition includes pending claims 8, 9, 11, 12, 17, 19-22, 25-30, 37, 38, 42, 43, 47, 49-51 and 54-58, which have been withdrawn from consideration by the Patent Office and which have not been canceled by the Applicants.

III.

Argument

The Applicants respectfully submit that the Restriction Requirement (Exhibit "B") is improper for various reasons. First, the guidelines of MPEP 803 set forth the specific requirements of an Examiner for properly restricting the claims of an application. For

example, "examiners must provide reasons and/or examples to support conclusions.... Where plural inventions are capable of being viewed as related in two ways, both applicable criteria for distinctness must be demonstrated to support a restriction requirement." (Guidelines, MPEP 803). Additionally, "for purposes of the initial requirement, a serious burden on the examiner may be *prima facie* shown if the examiner shows by appropriate explanation of separate classification, or separate status in the art, or a different field of search as defined in MPEP § 808.02." (Guidelines, MPEP 803; emphasis added).

In the present action, the Applicants respectfully submit that the Patent Office has not adequately demonstrated reasons or examples to support its conclusions. Moreover, the Patent Office has not provided any explanation of separate classification for the separate status in the art for the Species and the Sub-species, or that a different field of search is required to examine the restricted claims of Group II together in one application.

Second, the Applicants disagree with the analysis of the Examiner, which is based solely on sections 802.01 and 803 of the MPEP. The Applicants respectfully submit that the statutes and rules govern the requirements of an Examiner regarding whether a restriction is proper. More specifically, the MPEP "does not have the force of law (e.g., 35 U.S.C. § 121) or the force of the rules in Title 37 of the Code of Federal Regulations (e.g., 37 CFR 1.142)." (See, MPEP at the "Foreword" of the Title Page; parentheticals added for clarity). In this instance, the Applicants believe that the language of 35 U.S.C. § 121 and 37 CFR 1.142 on the one hand, and MPEP sections 802.01 and 803 on the other hand, are inconsistent as set forth below.

35 U.S.C. § 121 states in relevant part: "If two or more independent *and* distinct

inventions are claimed in one application, the Director may require the application to be restricted to one of the inventions." (35 U.S.C. § 121; emphasis added).

Further, 37 CFR 1.142(a) states in relevant part: "If two or more independent *and* distinct inventions are claimed in a single application, the examiner in an Office action will require the applicant in the reply to that action to elect an invention to which the claims will be restricted, this official action being called a requirement for restriction (also known as a requirement for division)." (37 CFR 1.142(a); emphasis added).

MPEP 803 quoted by the Patent Office in Exhibit D states as follows: "Under the statute an application may properly be required to be restricted to one of two or more claimed inventions only if they are able to support separate patents and they are either independent (MPEP § 806.04 - § 806.04(i)) or distinct (MPEP § 806.05 - § 806.05(i))." This language is clearly contrary to the language of the above-quoted statute and rule. In accordance with the Foreword of the MPEP, the law and rules govern over the MPEP. Consequently, a restriction in this case is only proper if independent and distinct inventions are claimed.

In the context of a restriction requirement, MPEP § 802.01 defines "independent" is as follows: "The term 'independent' (i.e., not dependent) means that there is no disclosed relationship between the two or more subjects disclosed, that is, they are unconnected in design, operation, or effect, for example: (1) species under a genus which species are not usable together as disclosed; or (2) process and apparatus incapable of being used in practicing the process." (MPEP § 802.01). Contrary to the apparent contention of the Examiner, the species identified by the Examiner, as explained in the specification of Exhibit "A", can be usable together. For example, an

asymmetrical storage disk can include one or more radial stiffeners (Group I) and one or more arc-shaped stiffeners (Group VI). In another example, the asymmetrical storage disk can include one or more tubular-shaped stiffening members (Group IV) and a damping layer (Group VII). It should be recognized that these are just two possible examples of how certain embodiments can be usable together, and that numerous other such combinations of embodiments could be likewise used together.

The MPEP further clarifies the definition of "independent" by providing examples, stating in relevant part: "An article of apparel such as a shoe, and a locomotive bearing would be an example. A process of painting a house and a process of boring a well would be a second example." (MPEP § 806.04(A)). In the present case, the twelve species set forth by the Examiner are much more strained and much less bright-lined than the clear examples expressed above in MPEP § 806.04(A).

In the Restriction Requirement, the Examiner appears to have drawn a distinction between the components illustrated in Figures 2C-7B of Exhibit "A" based upon the shape and/or composition of the asymmetrical storage disk. However, the Examiner appears to be disregarding that the structural components included in the embodiments illustrated in the Figures are not completely unconnected in design, operation, and effect, as required for a finding of independent inventions.

For instance, a number of Species designated by the Examiner include one or more features of an asymmetrical storage disk that can be used to control vibration and balance of the storage disk during rotation. In this example, at least Species I (Figures 2C and 2D), II (Figure 2E), IV (Figure 3A), V (Figure 3B), VI (Figure 3C), VII (Figure 4A), VIII (Figure 4B), IX (Figures 5A and 5B) and X (Figure 6) can each include one or more

features that can control vibration and/or balance the storage disk during rotation. As set forth in the specification, the stiffeners can provide one or more of the following effects: The "stiffeners 56 provide additional structural stiffening and rigidity to the storage disk 18 and decrease the amplitude of vibration and wobble during rotation of the storage disk 18. This helps preserve the flatness of the first side surface of the storage disk 18. With this design, greater accuracy in the transfer of data to and from the storage disk 18 can be achieved." (Exhibit "A", page 8, lines 19-23; emphasis added).

The specification further provides that "[a]s a result of the stiffeners 56, the increased rigidity of the second side region 62 maintains the first side surface 44 flatter, permitting lower flying heights without increasing the risk of contact between the slider and the storage disk 18. Decreased flying heights result in greater accuracy in the transfer of data to and from the storage disk 18. Further, maintaining a relatively constant distance between the read/write head and the first side surface 44 results in a more consistent signal strength, which decreases the potential for reading and writing errors. In addition, by varying the size, positioning and number of stiffeners 56, the storage disk 18 can be altered to achieve the desired level of stiffness to best suit the design requirements of the disk drive 10." (Exhibit "A", page 12, lines 7-16; emphasis added).

Moreover, the specification sets forth that the "damping layer 496A dampens or reduces the amplitude of vibration of the storage disk 418 during rotation." (Exhibit "A", page 15, lines 3-4; emphasis added). Further, the "constraining layer 498B enhances the damping properties of the damping layer 496B. The constraining layer 498B promotes the ability of the damping layer 496B to dissipate vibration of the storage disk

418B during rotation. In addition, the constraining layer 498B can provide increased rigidity of the storage disk 418B." (Exhibit "A", page 16, lines 4-8; emphasis added).

Further, the "projections 596 can serve to direct or disrupt airflow within the disk drive 10. Figure 5A provides one example of a random arrangement of projections 596 disposed onto the second side region 562 of the storage disk 518. Alternately, the projections 596 can be arranged in a specific pattern that is designed to minimize excessive vibration of the storage disk 518 due to air turbulence." (Exhibit "A", page 16, lines 17-22; emphasis added). Additionally "the projections 596 disrupt the cyclical movement of air between the second side surface 546 and the drive housing 512." (Exhibit "A", page 16, lines 25-27; emphasis added). With respect to Species 6 (Figure 7A), "if the storage disk 618 is determined to be out of balance based on testing performed during the manufacturing process, i.e. a portion of the storage disk 618 has disproportionately less mass than another portion of the storage disk 618, the supplemental layer 696 can be added to the second side surface 646 to improve the balance of the storage disk 618." (Exhibit "A", page 17, lines 9-13; emphasis added).

The MPEP also clearly states: "Claims to be restricted to different species must be mutually exclusive. The general test as to when claims are restricted, respectively, to different species is the fact that one claim recites limitations which under the disclosure are found in a first species but not in a second, while a second claim recites limitations disclosed only for the second species and not the first. This is frequently expressed by saying that claims to be restricted to different species must recite the mutually exclusive characteristics of such species." (MPEP §806.04(f); emphasis added). In other words, for a restriction between two species to be proper, the

characteristics of one of the species can only exist to the exclusion of the other species. In the present case, the species set forth by the Examiner do not necessarily follow this requirement.

In fact, the specification states that "the second side surface 46 can be used for increasing rigidity, controlling airflow, damping vibration, decreasing imbalance, and/or filtering impurities. With these designs, the storage disk 18 is asymmetrical." (Exhibit "A", page 7, lines 23-26; emphasis added). Thus, as supported by the specification, these embodiments ("species") are not wholly unconnected in design, operation, and effect. Therefore, the restriction requirement should be withdrawn or modified accordingly.

In addition, the rationale provided above likewise applies with respect to the three Subspecies identified by the Examiner. The Examiner has stated that "claims 8, 9, 13, 37, 38, 43, 67 and 68, which Applicants have indicated as being readable on the elected invention are in fact directed to a non-elected invention. Claims 8, 37 and 67 are directed to non-elected Sub-specie B, and claims 9, 38 and 68 are directed to non-elected Sub-specie C. Additionally, claims 13 and 43 are also directed to a non-elected Species IV." (Exhibit "D", page 4).

The Applicants respectfully disagree with the Subspecies designation by the Examiner. As set forth in the specification, "... the mass of the second side region can be greater or less than the mass of the first side region. ... Additionally, the density of the second side region can be greater or less than the density of the first side region. ... The thickness of the second side region can likewise vary from the thickness of the first side region." (Page 19, lines 8-25). Moreover, in "another embodiment, the second side region has a mass, thickness and/or density that is different than a mass, thickness

and/or density of the first side region." (Page 4, lines 8-10).

In accordance with the "mutual exclusion" requirement set forth above, an asymmetrical storage disk having a first side region with a mass that is different than a mass of the second side region does not preclude the storage disk from having the first side region with a thickness and/or density that is different from a thickness and/or density of the second side region. More specifically, the Applicants elected Subspecie A with traverse, which is directed toward an asymmetrical disk wherein the second side of the disk has a different mass than the first side of the disk. Claim 8, for example, requires that "the first side region has a thickness that is different than a thickness of the second side region." The election of the Applicants of Subspecie A does not preclude an asymmetrical disk having the features of claim 8.

Further, claim 9 requires that "the first side region has a density that is different than a density of the second side region." The election of the Applicants of Subspecie A does not preclude an asymmetrical disk having the features of claim 9. These are representative examples that the restriction requirement is improper, and are not intended to be exhaustive. Therefore, the Applicants submit that the requirement for restriction of the designated Subspecies be withdrawn.

IV.

Conclusion

Based on the foregoing, the Applicants assert that the election requirement with respect to the Species and Sub-species is improper, and that the instant Petition should be granted. Consequently, the pending claims included in Group II, comprising claims 2, 4-12, 14-31, 33, and 35-60, should be examined together as required pursuant to 35 U.S.C. § 121 and 37 CFR 1.142, as well as the applicable MPEP sections provided herein.

DATED this the 2nd day of March, 2004.

Respectfully submitted,

JAMES P. BRODER
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Registration No. 43,514

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Exhibit A

Express Mail No. ET414242705US

Docket No. 3123-424/20011.03

PATENT

OIPE JC
MAR 06 2004
PATENT & TRADEMARK

UNITED STATES PATENT APPLICATION

of

Erhard Schreck and Yanning Liu

for

ASYMMETRIC DISK SURFACE PROPERTIES IN ONE HEAD DISK DRIVES

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RELATED APPLICATION

This Application claims the benefit on U.S. Provisional Application Serial No. 60/298,969, filed on June 18, 2001. The contents of U.S. Provisional Application Serial No. 60/298,969 are incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates generally to disk drives for storing data. More specifically, the present invention relates to a storage disk of a disk drive.

BACKGROUND

Disk drives are widely used in computers and data processing systems for storing information in digital form. A typical disk drive includes an actuator motor, an E-block, one or more storage disks and one or more head suspension assemblies. The actuator motor moves the E-block relative to the storage disks. The E-block includes one or more actuator arms for positioning the one or more head suspension assemblies. Each head suspension assembly includes a slider and a read/write head.

Each storage disk typically includes a data storage surface on each side of the storage disk. The data storage surfaces are divided into a plurality of tracks. Figure 1 is a cross-sectional view of an example of a portion of a prior art storage disk 18P. The storage disk 18P illustrated in Figure 1 is formed beginning with a body region 58P made from an aluminum alloy. Layers of differing materials having varying thicknesses are symmetrically built up onto both sides of the body region 58P using plating or sputter depositing.

For example, moving outward from the body region 58P, the next layer can be a sublayer 70P made from a nickel alloy. The subsequent layer can be an underlayer 72P formed from a chromium alloy. Further, a magnetic layer 74P, an overcoat layer 76P and a lubricating layer 78P can be added to each side of the storage disk 18P. These layers usually vary in thickness from layer to layer. However, from one side of the storage disk 18P to the other, the thickness of each layer is substantially identical.

Recently, disk drives are being manufactured which utilize a single storage disk having only one data storage surface and one head suspension assembly ("one head disk drives"). These disk drives offer various advantages over disk drives having multiple storage surfaces, including a decreased complexity, i.e. requiring fewer mechanical and electrical components. For example, one head disk drives do not necessarily require the use of an E-block because only one actuator arm is needed to support the one head suspension assembly. As a consequence, the relative simplicity of one head disk drives can yield fewer reading and writing errors, resulting in increased accuracy and performance. Further, one head disk drives are typically more robust, easier to assemble, more physically compact and less costly to manufacture.

Moreover, the need to reduce data access times has led to increasing the rotational speed of the one or more storage disks. Because of the increased speed, the rotating storage disk(s) can generate significant air turbulence within the disk drive. Increased air turbulence can lead to unwanted vibration of the storage disk(s), and can effectively magnify any slight imbalance or other imperfections in the storage disk(s). For example, air turbulence can generate regions of low pressure near the storage disk(s), which are then filled

by air rushing in because of the pressure differential. This repeated cycle causes chaotic and random flutter or wobble of the storage disk(s), making accurate track following more difficult.

Additionally, flutter or wobble of the storage disk can cause unwanted contact with the slider, resulting in damage to the head suspension assembly, damage to the storage disk and/or the loss of data. Moreover, vibration of the storage disk can result in acoustical problems, which in applications such as digital video cameras, for example, can lower the ultimate sound recording quality.

In addition, in order to increase storage capacity, storage disks are being manufactured with increased track density, i.e. more tracks per inch. In conventional disk drives, each slider rides on an air bearing generated by rotation of the storage disk. The separation between the slider and the disk surface during rotation of the storage disk is referred to as the flying height. As track density increases, the flying height must necessarily decrease in order to maintain accuracy of the disk drive. Currently, flying heights can be 20 nanometers or less. A drawback of such low flying heights is that even slight vibration or imbalance of the storage disk can cause the slider to crash into the storage disk.

In light of the above, the need exists to provide a reliable, simple, and efficient disk drive. Another need exists to provide a storage disk that inhibits track misregistration, inhibits vibration, and/or reduces the amount of fluid turbulence around the storage disk. Yet another need exists to provide a disk drive utilizing a single storage disk, which is relatively easy and cost effective to manufacture, assemble and use.

SUMMARY

The present invention is directed to an asymmetrical storage disk for a disk drive. The storage disk includes a body region, a first side region secured to the body region, and an opposed second side region secured to the body region. The side regions are asymmetric relative to the body region.

In one embodiment, the first side region is adapted to store data, and the second side region is not adapted to store data. In this embodiment, for example, (i) the first side region includes one or more servo sectors, and the second side region does not include any servo sectors, and/or (ii) the first side region includes a magnetic layer, and the second side region does not include a magnetic layer. In a further embodiment, the first side region includes a first layer and the second side region includes a second layer that is made from a different material than the first layer. In another embodiment, the second side region has a mass, thickness and/or density that is different than a mass, thickness and/or density of the first side region.

Additional embodiments of the storage disk incorporate one or more stiffeners into the second side region of the storage disk. The stiffeners can be positioned and sized to increase rigidity of the storage disk. The stiffeners can be radial, tubular, arc-shaped, or can be configured in other suitable shapes. In yet another embodiment, the second side region can include a plurality of projections. In still another embodiment, the second side region can include a supplemental layer that improves the balance of the storage disk during disk rotation. The supplemental layer can have a non-uniform thickness.

In yet another embodiment, the second side region includes a damping layer that reduces the vibration of the storage disk. Additionally, a constraining layer can be incorporated into the second side region adjacent to the damping layer.

In still another embodiment, the second side region includes an adsorption layer that absorbs dust, debris and volatiles. In this embodiment, the second side region can also include a diffusion layer that is positioned adjacent to the adsorption layer.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features of this invention, as well as the invention itself, both as to its structure and its operation, will be best understood from the accompanying drawings, taken in conjunction with the accompanying

description, in which similar reference characters refer to similar parts, and in which:

Figure 1 is a cross-sectional view of a portion of a prior art storage disk;

Figure 2A is a simplified perspective view of a disk drive having features of the present invention;

Figure 2B is a bottom view of a storage disk having features of the present invention;

Figure 2C is a perspective view of an embodiment of a storage disk having features of the present invention;

Figure 2D is a partial cross-sectional view taken at line 2D-2D in Figure 2C;

Figure 2E is an alternate cross-sectional view of a portion of the storage disk;

Figure 2F is another cross-sectional view of a portion of the storage disk;

Figure 2G illustrates a step in the manufacturing of the storage disk in Figure 2F;

Figure 2H illustrates another step in the manufacturing of the storage disk in Figure 2F;

Figure 2I illustrates another step in the manufacturing of the storage disk in Figure 2F;

Figure 3A is a perspective view of another embodiment of a storage disk having features of the present invention;

Figure 3B is a perspective view of yet another embodiment of a storage disk having features of the present invention;

Figure 3C is a perspective view of still another embodiment of a storage disk having features of the present invention;

Figure 4A is a partial cross-sectional view of a portion of another embodiment of a storage disk having features of the present invention;

Figure 4B is a partial cross-sectional view of a portion of still another embodiment of a storage disk having features of the present invention; and

Figure 5A is a top view of another embodiment of a storage disk having features of the present invention;

Figure 5B is a side view of the storage disk in Figure 5A and a portion of a drive housing;

Figure 6 is a top view of yet another embodiment of a storage disk having features of the present invention;

Figure 7A is a partial cross-sectional view of another embodiment of a portion of a storage disk having features of the present invention; and

Figure 7B is a partial cross-sectional view of a portion of still another embodiment of a storage disk having features of the present invention.

DESCRIPTION

The present invention provides a method and apparatus for decreasing vibration and imbalance of a storage disk for use in a disk drive. The present invention is particularly suited to one head disk drives having a single storage disk.

Referring initially to Figure 2A, the disk drive 10 includes (i) a drive housing 12, (ii) a head stack assembly 14, and (iii) a disk assembly 16 having a storage disk 18. The drive housing 12 retains the various components of the disk drive 10. The drive housing 12 includes a housing base 20, four side walls 22, and a housing cover (not shown in Figure 2A for clarity).

The head stack assembly 14 illustrated in Figure 2A includes an actuator hub 24, an actuator arm 26, a head suspension assembly 28 and an actuator motor 30. The actuator motor 30 rotates the actuator hub 24 and the head suspension assembly 28 relative to the storage disk 18. Only a portion of the actuator motor 30 is illustrated in Figure 2A. The head suspension assembly 28 includes a load beam 32, a flexure (not shown) and a slider assembly 36. The load beam 32 is secured to the actuator arm 26, and supports the slider assembly 36 proximate one side of the storage disk 18. The slider assembly 36 includes a slider 38 and a read/write head 40 that transfers information to and from the storage disk 18.

The disk assembly 16 includes a disk spindle 42 and the storage disk 18. The disk spindle 42 is rotatably mounted to the drive housing 12. The storage

disk 18 is fixedly secured to the disk spindle 42. The disk spindle 42 and the storage disk 18 are adapted to rotate at a predetermined angular velocity.

The storage disk 18 is generally disk shaped and stores data in a form that can be subsequently retrieved if necessary. The storage disk 18 includes a first side surface 44 (illustrated in Figure 2B) and an opposed second side surface 46. In Figure 2A, the second side surface 46 is facing upward. Alternately, for example, the second side surface 46 could be facing downward. In Figure 2A, during operation of the disk drive 10, the read/write head 40 is positioned over the first side surface 44 by the actuator motor 30.

The storage disk 18 is particularly suited to be a magnetic storage disk. Moreover, the materials utilized in the storage disk 18 can include metals, ceramics, glass, plastics, other suitable materials, or combinations of these materials. In addition, the diameter of the storage disk 18 can vary. For instance, the storage disk 18 can have a diameter of approximately one inch, two and one half inches, three and one half inches, or any other suitable diameter depending upon the design requirements of the disk drive 10.

The disk drive 10 illustrated in Figure 2A also includes a ramp 47 that supports the slider 38 away from the storage disk 18 during non-rotation of the storage disk 18.

In Figure 2A, the second side surface 46 generally faces away from the read/write head 40 during reading and/or writing operations. Thus, the second side surface 46 can be used for other purposes than storing data. For example, as provided in detail below, the second side surface 46 can be used for increasing rigidity, controlling airflow, damping vibration, decreasing imbalance, and/or filtering impurities. With these designs, the storage disk 18 is asymmetrical.

Figure 2B illustrates a bottom plan view of the storage disk 18, including the first side surface 44. The first side surface 44 is substantially flat and includes a plurality of concentric tracks 48 of different radii, each of which is adapted to store data. Although Figure 2B only illustrates a relatively small number of tracks 48, the first side surface 44 can have many thousands of tracks 48. The first side surface 44 also includes a plurality of data sectors 50

and a plurality of servo sectors 52 in each track 48. Data from a host user can be written to, and retrieved from, the data sectors 50. It is recognized that inclusion of servo sectors 52 on the first side surface 44 of storage disk 18 can be implemented in various ways known to those skilled in the art.

The servo sectors 52 in each track 48 are radially aligned with servo sectors 52 in other tracks 48, thereby forming servo wedges 54 that extend radially across the storage disk 18. During a seek operation or a track following operation, the read/write head (not shown in Figure 2B) samples the servo sector 52 each time it crosses over one. The read/write head then delivers positioning information to a servo controller (not shown). Consequently, the servo controller updates a control signal to the actuator motor (not shown on Figure 2B) based on the current position of the read/write head relative to the desired track 48, causing the actuator motor to reposition the read/write head, if necessary.

Figure 2C illustrates a top perspective view of a first embodiment of the asymmetric storage disk 18. In this embodiment, the second side surface 46 includes one or more generally rigid, stiffeners 56 that extend substantially radially from the inner diameter towards the outer diameter of the storage disk 18. The stiffeners 56 provide additional structural stiffening and rigidity to the storage disk 18 and decrease the amplitude of vibration and wobble during rotation of the storage disk 18. This helps preserve the flatness of the first side surface of the storage disk 18. With this design, greater accuracy in the transfer of data to and from the storage disk 18 can be achieved.

Although Figure 2C illustrates eight, radial stiffeners 56, any number of stiffeners 56 can be incorporated into the storage disk 18. Further, the dimensions of each stiffener 56 can vary depending upon the design requirements of the disk drive 10. For example, in Figure 2C, the width of each stiffener 56 increases from the inner diameter to the outer diameter of the storage disk 18. Alternatively, the width of each stiffener 56 can be uniform, or can decrease from the inner diameter to the outer diameter. Moreover, the width and height of the stiffeners 56 can vary from stiffener 56 to stiffener 56. In Figure 2C each stiffener 56 has a generally rectangular shape cross-section.

Alternately, for example, each stiffener 56 could have a triangular shaped cross-section.

Additionally, the materials utilized for the stiffeners 56 and the exact placement of the stiffeners 56 can vary. For example, each stiffener 56 can be formed from materials that provide additional stiffening and which do not significantly interfere with the magnetic properties of the storage disk 18. For example, various aluminum alloys can be used to form the stiffeners 18, although any other suitable materials can likewise be utilized.

It should be noted in Figure 2C, that the second side surface 46 is not adapted to store data and does not include data tracks, servo sectors or servo wedges.

Figure 2D illustrates a cut-away view of a portion of the storage disk 18 of Figure 2C. As illustrated in Figure 2D, the storage disk 18 includes a body region 58, a first side region 60, and a second side region 62. The design, thickness, and shape of each of the regions 58, 60, 62 can be varied pursuant to the teachings provided herein. It should be noted that because of the relative disparity between thicknesses of the different regions 58, 60, 62, the thicknesses of the different regions 58, 60, 62 in Figure 2D are not to scale.

The body region 58 that supports the side regions 60, 62, is generally disk shaped, and includes a first body side 64 and an opposed second body side 66. A central disk plane 68 (shown in phantom) bisects the body region 58 intermediate the body sides 64, 66. The body sides 64, 66 are on opposite sides of the central disk plane 68 and are substantially parallel to the central disk plane 68. The body region 58 is generally rigid and can be formed from an aluminum magnesium alloy, for example, although other sufficiently rigid materials can be used. The thickness of the body region 58 can be between approximately 0.5 millimeters and 2.0 millimeters, although other thicknesses can be utilized.

The first side region 60 defines the first side surface 44 that is adapted to store data and includes one or more first layers. In Figure 2D, the first side region 60 includes a first sublayer 70, a first underlayer 72, a first magnetic layer 74, a first overcoat layer 76 and a first lubricating layer 78 that are

sequentially plated or sputter deposited onto the body region 58. The first side surface 44 can be burnished to minimize imperfections or variations.

The precise materials used and the thicknesses of each first layer can be varied to suit the requirements of the disk drive 10. For example, the first sublayer 70 can be formed from a nickel phosphorus material having a thickness of approximately 10,000 nanometers. The first underlayer 72 can be formed from a chromium alloy having a thickness of approximately 50 nanometers. The first magnetic layer 74 can include materials such as cobalt and chromium, and can have a thickness of approximately 25 nanometers. The first overcoat layer 76 can include a carbon-based material with a thickness of approximately 7.5 nanometers. The first lubricating layer 78 can have a thickness of approximately 1 nanometer. However, the first side region 60 need not include all of the layers specified above and/or the first side region 60 can include additional layers than those described above.

The second side region 62 defines the second side surface 46 and includes one or more second layers. In Figure 2D, the second side region 62 includes a second sublayer 80, a second underlayer 82, a second magnetic layer 84, a second overcoat layer 86 and a second lubricating layer 88 that are sequentially plated or sputter deposited onto the body region 58.

The precise materials used and the thicknesses of each second layer can vary to suit the requirements of the disk drive 10. For example, the second sublayer 80 can be formed from a nickel phosphorus material having a thickness of approximately 10,000 nanometers. The second underlayer 82 can be formed from a chromium alloy having a thickness of approximately 50 nanometers. The second magnetic layer 84 can include materials such as cobalt and chromium, and can have a thickness of approximately 25 nanometers. The second overcoat layer 86 can include a carbon-based material with a thickness of approximately 7.5 nanometers. The second lubricating layer 88 can have a thickness of approximately 1 nanometer. However, the second side region 46 need not include all of the second layers specified above, and/or the second side region 46 can include additional layers than those described above.

Is should be noted that in Figure 2D, the number and thicknesses of first layers of the first side region 44 are substantially the same as the number and thicknesses of the second layers of the second side region 46. However, the number of first layers in the first side region 44 can be greater or less than the number of second layers in the second side region 46. For example, because the second side surface 46 does not need to be adapted to store data, the second side region 46 can be designed to not include the second magnetic layer 84. Therefore, one or more of the second layers of the second side region 62 shown in Figure 2D can be omitted, or substituted with a different material, with no detrimental effects to operation of the disk drive 10.

Figure 2D illustrates that each stiffener 56 can be formed as an integral part of the body region 58. In this embodiment, each stiffener 56 is a beam 89 that extends upward from the second body side 66 and each stiffener 56 is made from the same material as the body region 58. Subsequently, the second layers are sequentially plated or sputter over the beam 89 and the body region 58.

Alternately, for example, each stiffener 56 can be a beam that is adhered to the body region 58, a beam secured to the top of the second side surface 46, or a beam positioned within the second layers of the second side region 62. Still alternately, material of sufficient strength can be added directly onto the second side surface 46 to form the stiffeners 56. In another embodiment, material can be removed from the second side surface 46 during the manufacturing process, effectively leaving material forming one or more the raised stiffeners 56 on the second side region 62.

The height of each stiffener 56 can vary. For example, each stiffener 56 can have a height of between approximately 0.001 millimeters and 2.0 millimeters. In Figure 2D, because of the stiffeners 56, the second side surface 46 includes a plurality of outer flat sections 90 and a plurality of outer ridged sections 92 that extend above the outer flat sections 90. The ridged sections 92 can have any height that does not cause substantial interference with rotation of the storage disk 18, e.g., contact the drive housing (not shown on Figure 2D). For example, each ridged section 92 can extend between

approximately 0.001 millimeters and 2.0 millimeters away from the outer flat sections 90.

It should be noted from Figure 2D, that the storage disk 18 is asymmetrical. Stated another way, the first side region 60 and the second side region 62 are not symmetrical relative to the body region 58 and the central disk plane 68.

As a result of the stiffeners 56, the increased rigidity of the second side region 62 maintains the first side surface 44 flatter, permitting lower flying heights without increasing the risk of contact between the slider and the storage disk 18. Decreased flying heights result in greater accuracy in the transfer of data to and from the storage disk 18. Further, maintaining a relatively constant distance between the read/write head and the first side surface 44 results in a more consistent signal strength, which decreases the potential for reading and writing errors. In addition, by varying the size, positioning and number of stiffeners 56, the storage disk 18 can be altered to achieve the desired level of stiffness to best suit the design requirements of the disk drive 10.

Figure 2E illustrates a cross-sectional view of another embodiment of the storage disk 218E. In this embodiment, the first side region 260E is similar to the first side region 60 described above. Further, each stiffener 256E is a beam 289E that is integrally formed and extends above the second body side 266E of the body region 258E. However, in Figure 2E, one or more of the second layers 280E, 282E, 284E, 286E, 288E of the second side region 262E are not deposited over each beam 289E. As a result thereof, the second side surface 246E is substantially flat.

Figure 2F illustrates a cross-sectional view of another embodiment of the storage disk 218F. In this embodiment, the first side region 260F is similar to the first side region 60 described previously. However, in this embodiment, there is no second side region. Stated another way, the second body side 266F of the body region 258F is exposed and is not covered with the second side region. In this design, the second body side 266F defines the second side surface 246F. With this design, the storage disk 218F illustrated in Figure 2F can be efficiently and cost-effectively manufactured, as described below.

Referring to Figure 2G, the process used to manufacture the storage disk 218F (shown in Figure 2F) includes positioning two body regions 58 so that one of the body sides 64, 66 of one of the body regions 58 is adjacent to and abuts against one of the body sides 64, 66 of the other body region 58. In this manner, each body region 58 will have an exposed body side 296G and a hidden body side 298H.

Next, layers of material are added to both of the exposed body sides 296F, as illustrated in Figure 2H. These layers of material can be similar to those included in the first side region 60 previously described, to form a first side region 260H on each exposed body side 296H. The method of adding these layers of material can be by sputter deposition or electroplate deposition, as examples. A layering device 299H is utilized to add the layers of material to the exposed body sides 296G.

The body regions 58 are then separated, each retaining the added layers of material. Figure 2I illustrates the two asymmetric storage disks 218I that are formed by separating the body regions 58.

Figure 3A illustrates a perspective view of another embodiment of an asymmetrical storage disk 318A. In this embodiment, the second side region 362A including a plurality of spaced apart, substantially concentric, tubular shaped stiffeners 356A, each having a different radaii. In this embodiment, the stiffeners 356A are centered about a rotational axis 394A of the storage disk 318A. Although Figure 3A illustrates that the second side region 362A includes five concentric stiffeners 356A, any number of concentric stiffeners 356A can be used.

Figure 3B illustrates a perspective view of still another embodiment of an asymmetrical storage disk 318B. In this embodiment, the second side region 362B including a spiral shaped stiffener 356B that extends from the inner diameter to the outer diameter of the storage disk 318B. The stiffener 356B can be centered about the rotational axis 394B of the storage disk 318B.

Figure 3C illustrates a perspective view of yet another embodiment of an asymmetrical storage disk 318C. In this embodiment, the second side region 362C including a plurality of spaced apart, substantially arc-shaped stiffeners

356C that extend from the inner diameter towards the outer diameter. Although Figure 3C illustrates that the second side region 362C includes eight stiffeners 356C, any number of stiffeners 356C can be used.

In Figure 3C, each stiffener 356C is tapered in width from the inner diameter to the outer diameter of the storage disk 318C. With this design, the stiffeners 356C not only decrease imbalance and augment rigidity to the storage disk 318C as provided previously, the stiffeners 356C can also regulate the flow of fluid generated by the rotating storage disk 318C. Depending upon the direction of rotation, i.e. clockwise or counterclockwise, turbulent fluid flow can be better directed within the drive housing (not shown in Figure 3C) than with the substantially flat second side surface of a prior art storage disk that offers essentially no airflow guidance. With this design, the fluid within the disk drive can be moved in a manner that is advantageous to the functioning of the drive components. More specifically, the configuration and number of the stiffeners 356C can be tailored to be consistent with the design characteristics of the disk drive 10. For example, fluid flow can be steered away from more sensitive drive components such as the read/write head (not shown in Figure 3C), for example, directed to other drive components for cooling or filtering purposes, or for other reasons beneficial to operation of the disk drive 10.

Figure 4A illustrates a cross-sectional view of another embodiment of an asymmetric storage disk 418A. In this embodiment, the storage disk 418A includes the body region 458A bisected by the central disk plane 468A, the first side region 460A and the second side region 462A. The body region 458A and the first side region 460A are somewhat similar to the corresponding components described above. The first side region 460A includes a first sublayer 470A, a first underlayer 472A, a first magnetic layer 474A, a first overcoat layer 476A and a first lubricating layer 478A that are sequentially plated or sputter deposited onto the body region 458A.

However, in this embodiment, the second side region 462 includes a second sublayer 480A and a damping layer 496A. The second sublayer 480A, for example, can be an adhesive that bonds the damping layer 496A to the

body region 458A, although the presence of the second sublayer 480A in this embodiment is not required.

The damping layer 496A dampens or reduces the amplitude of vibration of the storage disk 418 during rotation. The damping layer 496A can be a coating of viscoelastic material, a self-adhesive viscoelastic film material, or other suitable damping material compositions that result in a decreased amplitude of vibration of the storage disk 418A. The thickness of the damping layer 496A can be varied. For example, the damping layer 496A can be any thickness that does not significantly interfere with rotation of the storage disk 418A. Further, the thickness of the damping layer 496A can vary over the topography of the second side region 462A. For example, the storage disk 418A may require that a thicker damping layer 496A be added in one area of the second side region 462A than in another area of the second side region 462A to provide greater rotational balance of the storage disk 418A. The average thickness of the damping layer 496A can be less than two millimeters. Alternately, for example, the average thickness can be between approximately 0.001 millimeters and 1.0 millimeters.

It should be noted that the second side region 462A does not include the same number of layers as the first side region 460A. As a result thereof, the second side region 462A can have a thickness, a mass, a density, and/or a material composition that is different than the first side region 460A. Further, the second side region 462A does not include a magnetic layer. Moreover, at least one of the second layers that is equidistant from the body region 458A as one of the first layers has a different material composition, density, mass and/or thickness.

Figure 4B illustrates still another embodiment of the storage disk 418B having asymmetric properties. In this embodiment, the storage disk 418B includes the body region 458B bisected by the central disk plane 468B, the first side region 460B and the second side region 462B. The first side region 460B can again include the first sublayer 470B, the first underlayer 472B, the magnetic layer 474B, the first overcoat layer 476B and the first lubricating layer 478B that are similar to the equivalent layers described above.

The second side region 462B includes the second sublayer 480B, the damping layer 496B and a constraining layer 498B on top of the damping layer 496B so that the damping layer 496B is positioned between the constraining layer 498B and the body region 458B. The constraining layer 498B enhances the damping properties of the damping layer 496B. The constraining layer 498B promotes the ability of the damping layer 496B to dissipate vibration of the storage disk 418B during rotation. In addition, the constraining layer 498B can provide increased rigidity of the storage disk 418B. The constraining layer 498B can be formed from various materials, such as aluminum alloys or other metals, glass, ceramic or plastic. The thickness of the constraining layer 498B can vary to suit the needs of the disk drive. For example, the constraining layer 498B can be any thickness that does not interfere with rotation of the storage disk 418B. Preferably, the thickness of the constraining layer 498B can be between 0.0001 millimeters and 1.0 millimeter.

Figures 5A illustrates another embodiment of the asymmetric storage disk 518. In this embodiment, the second side region 562 of the storage disk 518 includes a plurality of projections 596 on the second side surface 546. The projections 596 can serve to direct or disrupt airflow within the disk drive 10. Figure 5A provides one example of a random arrangement of projections 596 disposed onto the second side region 562 of the storage disk 518. Alternately, the projections 596 can be arranged in a specific pattern that is designed to minimize excessive vibration of the storage disk 518 due to air turbulence.

Figure 5B illustrates a side view of the storage disk 518 in Figure 5A, including a portion of the drive housing 512 immediately adjacent to the second side region 562. In this embodiment, the projections 596 disrupt the cyclical movement of air between the second side surface 546 and the drive housing 512. The pattern, shape and size of the projections 596 can be varied according to the design requirements of the disk drive 10, or to account for any imbalance that may have been identified during the testing portion of the manufacturing process. Further, the height of each projection 596 can vary from projection to projection. For example, the projections 596 can have a height that is between approximately 0.0001 millimeters and 0.5 millimeters

above the rest of the second side surface 546, although the projections 596 can be less than 0.001 millimeters in height. The projections 596 can be formed by plating, by sputter deposition or by other appropriate methods.

Figure 6 illustrates another embodiment of the asymmetric storage disk 618. In this embodiment, the storage disk 618 includes a supplemental layer 696 (shown as dots) that is added to at least a portion of the second side surface 646. Because the second side surface 646 is not adapted to store data, the second disk surface 618 can be modified during production. For example, if the storage disk 618 is determined to be out of balance based on testing performed during the manufacturing process, i.e. a portion of the storage disk 618 has disproportionately less mass than another portion of the storage disk 618, the supplemental layer 696 can be added to the second side surface 646 to improve the balance of the storage disk 618.

The composition of the supplemental layer 696 can vary to suit the design requirements of the disk drive 10. The supplemental layer 696 can be one of the same materials used in formation of another layer of the storage disk 618, in order to simplify the manufacturing process and decrease production costs. For example, a nickel alloy or an aluminum alloy used in other layers of the storage disk 618 can be added to the second side surface 646 by a plating process, by a sputter-deposit method, or by any other suitable method recognized in the art. Alternatively, any other suitable material can be used for the supplemental layer 696. The thickness of the supplemental layer 696 can vary depending upon the level of imbalance found during testing. The supplemental layer 696 can be thicker in some areas of the second side surface 646, and can feather out and dissipate so that other areas of the second side surface 646 are devoid of the supplemental layer 646, as shown in undotted portions of Figure 6.

Figure 7A illustrates a cross-sectional view of another embodiment of an asymmetrical storage disk 718A. In this embodiment, the storage disk 718 includes the body region 758A that is bisected by the central disk plane 768A, the first side region 760A and the second side region 762A. The first side region 760A can include the first sublayer 770A, the first underlayer 772A, the

first magnetic layer 774A, the first overcoat layer 776A and the first lubricating layer 778A.

The second side region 762A includes the second sublayer 780A, and an adsorption layer 796A that adsorbs organic and/or inorganic impurities (not shown) from the interior of the disk drive. The adsorption layer 796A can be comprised of a chemical adsorbent that is capable of filtering outgases (not shown) and other vapors generated during the life span of the disk drive. The adsorption layer 796A can be porous and sized to allow air or other fluids within the disk drive to flow around the chemical adsorbent, allowing the chemical adsorbent to filter the desired chemicals by absorption and/or adsorption. The adsorption layer 796A can be adhesively applied to the any of the layers of the second side region 762A of the storage disk 718, or can be secured by any other suitable method. The adsorption layer 796A can be the outermost layer on the second side region 762A of the storage disk 718, as illustrated in Figure 7A. The absorption layer 796A can have a thickness of between approximately 0.005 millimeters and 0.1 millimeters, for example.

Figure 7B illustrates yet another embodiment of the asymmetric storage disk 718B, including the body region 758B, the first side region 760B and the second side region 762B. The first side region 760B can be formed similar to that shown in Figure 7A, for example. The second side region 762B can include the second sublayer 780B, the absorption layer 796B, and a diffusion layer 798B that covers the adsorption layer 796B. The diffusion layer 798B filters out dust, debris, volatiles and other particles (not shown) within the disk drive. The diffusion layer 798B can be removably secured to the adsorption layer 796B so that the chemical adsorbent of the adsorption layer 796B can be replaced if necessary. Alternate ways to secure the diffusion layer 798B can also be utilized provided operation of the disk drive is not compromised. The diffusion layer 798B can be constructed from a variety of known and available materials for disk drive applications, including electrostatic media and/or membrane. Moreover, the second side region 762B can exclude the adsorption layer 798B, with the diffusion layer 796B being adhered to any of the other layers of the second side region 762B of the storage disk 718, for example.

The diffusion layer 796B can have a thickness of between approximately 0.05 mm and 0.1 mm.

In addition to the embodiments set forth above, various other embodiments of the present invention are contemplated which have asymmetric properties relative to the body region and/or the central disk plane. Moreover, the second side region can be utilized for other purposes that serve to enhance operation of the disk drive other than those provided herein.

To any feasible extent, the mass of the second side region can be greater or less than the mass of the first side region. For example, the mass of the second side region can differ from the mass of the first side region by at least approximately 1.0 percent. In another embodiment, the mass of the second side region can differ from the mass of the first side region by at least approximately 0.01 percent. In still another embodiment, the mass of the second side region can differ from the mass of the first side region by at least approximately 0.0001 percent.

Additionally, the density of the second side region can be greater or less than the density of the first side region. For instance, the density of the second side region can differ from the density of the first side region by at least approximately 1.0 percent. In another embodiment, the density of the second side region can differ from the density of the first side region by at least approximately 0.01 percent. In yet another embodiment, the density of the second side region can differ from the density of the first side region by at least approximately 0.0001 percent.

The thickness of the second side region can likewise vary from the thickness of the first side region. In one embodiment of the storage disk, the thickness of the second side region can differ from the thickness of the first side region by at least approximately 0.1 percent. In another embodiment, the thickness of the second side region can differ from the thickness of the first side region by at least approximately 0.001 percent. In a further embodiment, the thickness of the second side region can differ from the thickness of the first side region by at least approximately 0.00001 percent.

Further, although the storage disks described herein are particularly suited to one-head disk drives 10, the storage disks can also be incorporated into multiple head disk drives. For example, a disk drive 10 with multiple storage disks can utilize one or more asymmetrical storage disks in accordance with the teachings provided herein. The remaining storage disks can be conventional storage disks having two data storage surfaces that can each interact with a corresponding read/write head.

While the particular storage disks and disk drive 10 as herein shown and disclosed in detail, are fully capable of obtaining the objects and providing the advantages herein before stated, it is to be understood that it is merely illustrative of the presently preferred embodiments of the invention and that no limitations are intended to the details of construction or design herein shown other than as described in the appended claims.

What is claimed is:

1. A disk drive comprising:

a drive housing; and

an asymmetrical storage disk rotatably coupled to the drive housing.

2. The disk drive of claim 1 wherein the storage disk includes a first side region, a spaced apart second side region and a body region that is positioned between the side regions, the side regions being asymmetrical relative to the body region.

3. The disk drive of claim 2 wherein the first side region is adapted to store data, and the second side region is not adapted to store data.

4. The disk drive of claim 2 wherein the first side region includes a plurality of servo sectors, and the second side region does not include any servo sectors.

5. The disk drive of claim 2 wherein the first side region includes a magnetic layer, and the second side region does not include a magnetic layer.

6. The disk drive of claim 2 wherein the first side region includes a first layer and the second side region includes a second layer, the first layer and the second layer being substantially equidistant from the body region, wherein the first layer is formed from a material having a first composition, and the second layer is formed from material having a second composition that is different from the first composition.

7. The disk drive of claim 2 wherein the first side region has a mass that is different than a mass of the second side region.

8. The disk drive of claim 2 wherein the first side region has a thickness that is different than a thickness of the second side region.

9. The disk drive of claim 2 wherein the first side region has a density that is different than a density of the second side region.

10. The disk drive of claim 2 wherein the second side region includes a stiffener that increases the rigidity of the storage disk.

11. The disk drive of claim 10 wherein the stiffener extends substantially radially from near an inner diameter of the storage disk.

12. The disk drive of claim 11 wherein the second side region includes an outer flat section and the stiffener is raised at least approximately 0.001 millimeters above the outer flat section.

13. The disk drive of claim 10 wherein the stiffener is tubular shaped.

14. The disk drive of claim 10 wherein the stiffener redirects fluid within the drive housing during rotation of the storage disk.

15. The disk drive of claim 10 wherein the stiffener is substantially arc-shaped.

16. The disk drive of claim 2 wherein the storage disk includes a plurality of stiffeners that increase the rigidity of the storage disk.

17. The disk drive of claim 16 wherein the second side region includes an outer flat section, and wherein at least one of the stiffeners is positioned below the outer flat section.

18. The disk drive of claim 16 wherein the second side region includes an outer flat section and wherein each of the stiffeners is raised above the outer flat region.

19. The disk drive of claim 2 wherein the second side region includes a damping layer that dampens vibration of the storage disk during rotation, and wherein the first side region does not include a damping layer.

20. The disk drive of claim 19 wherein the damping layer includes a viscoelastic material.

21. The disk drive of claim 19 wherein the damping layer includes a material that is applied with an adhesive.

22. The disk drive of claim 19 wherein the second side region includes a constraining layer that constrains the damping layer, wherein the damping layer is positioned between the constraining layer and the body region.

23. The disk drive of claim 2 wherein the second side region includes an outer flat section and a plurality of projections that extend above the outer flat section.

24. The disk drive of claim 23 wherein at least one of the projections is raised above the outer flat region by at least approximately 0.001 millimeters.

25. The disk drive of claim 2 wherein the second side region includes a supplemental layer that balances the storage disk.

26. The disk drive of claim 25 wherein the supplemental layer has a non-uniform thickness.

27. The disk drive of claim 2 wherein the second side region includes an adsorption layer that adsorbs impurities within the drive housing.

28. The disk drive of claim 27 wherein the adsorption layer includes a chemical adsorbent.

29. The disk drive of claim 27 wherein the second side region includes a diffusion layer that is positioned adjacent to the adsorption layer, the diffusion layer being adapted to filter out unwanted particles within the drive housing.

30. The disk drive of claim 1 wherein the storage disk includes a body region having a first body side and an opposed second body side, wherein one of the body sides is exposed.

31. A storage disk for a disk drive, the storage disk comprising:

a body region;

a first side region secured to the body region; and

a substantially opposed second side region secured to the body region;

wherein the side regions are asymmetrical relative to the body region.

32. The storage disk of claim 31 wherein the first side region is adapted to store data, and the second side region is not adapted to store data.

33. The storage disk of claim 31 wherein the first side region includes a plurality of servo sectors, and the second side region does not include any servo sectors.

34. The storage disk of claim 31 wherein the first side region includes a magnetic layer, and the second side region does not include a magnetic layer.

35. The storage disk of claim 31 wherein the first side region includes a first layer and the second side region includes a second layer, the first layer and the second layer being substantially equidistant from the body region, wherein the first layer is formed from a material having a first composition, and the second layer is formed from material having a second composition that is different from the first composition.

36. The storage disk of claim 31 wherein the first side region has a mass that is different than a mass of the second side region.

37. The storage disk of claim 31 wherein the first side region has a thickness that is different than a thickness of the second side region.

38. The storage disk of claim 31 wherein the first side region has a density that is different than a density of the second side region.

39. The storage disk of claim 31 wherein the second side region includes a stiffener that increases the rigidity of the storage disk.

40. The storage disk of claim 39 wherein the second side region includes an outer flat section, and wherein the stiffener extends away from the outer flat section.

41. The storage disk of claim 40 wherein the stiffener extends away from the outer flat section at least approximately 0.001 millimeters.

42. The storage disk of claim 39 wherein the stiffener extends substantially radially from an inner diameter of the second side region.

43. The storage disk of claim 39 wherein the stiffener is tubular shaped.

44. The storage disk of claim 39 wherein the stiffener redirects fluid during rotation of the storage disk.

45. The storage disk of claim 39 wherein the stiffener is substantially arc-shaped.

46. The storage disk of claim 31 wherein the second side region includes a plurality of spaced apart stiffeners that increase the rigidity of the second side region.

47. The storage disk of claim 46 wherein the second side region includes an outer flat section, and wherein at least one of the stiffeners is positioned below the outer flat section.

48. The storage disk of claim 46 wherein the second side region includes an outer flat section and each of the stiffeners extends away from the outer flat section.

49. The storage disk of claim 31 wherein the second side region includes a damping layer that dampens vibration of the storage disk, and wherein the first side region does not include a damping layer.

50. The storage disk of claim 49 wherein the damping layer includes a viscoelastic material.

51. The storage disk of claim 49 wherein the second side region includes a constraining layer that constrains the damping layer, wherein the damping layer is positioned between the constraining layer and the body region.

52. The storage disk of claim 31 wherein the second side region includes an outer flat region and a plurality of projections that extend away from the outer flat region.

53. The storage disk of claim 52 wherein at least one of the projections extends away from the outer flat region at least approximately 0.001 millimeters.

54. The storage disk of claim 31 wherein the second side region includes a supplemental layer that balances the storage disk during rotation of the storage disk.

55. The storage disk of claim 54 wherein the supplemental layer has a non-uniform thickness.

56. The storage disk of claim 31 wherein the second side region includes an adsorption layer that adsorbs impurities.

57. The storage disk of claim 56 wherein the adsorption layer includes a chemical adsorbent.

58. The storage disk of claim 56 wherein the second side region includes a diffusion layer that is positioned adjacent to the adsorption layer, the diffusion layer being adapted to filter out unwanted particles.

59. The storage disk of claim 31 wherein the first side region has a first shape and the second side region has a second shape, and wherein the first shape is different than the second shape.

60. A disk drive including a drive housing and the storage disk of claim 31.

61. A method for making a disk drive, the method comprising the steps of:

providing a drive housing;

providing an asymmetrical storage disk; and

coupling the asymmetrical storage disk to the drive housing.

62. The method of claim 61 wherein the step of providing an asymmetric storage disk includes providing a first side region, providing a spaced apart second side region and providing a body region that is positioned between the side regions, the side regions being asymmetrical relative to the body region.

63. The method of claim 61 wherein the step of providing an asymmetric storage disk includes providing a first side region that is adapted to store data, and the step of providing a second side region that is not adapted to store data.

64. The method of claim 61 wherein the step of providing an asymmetric storage disk includes providing a first side region that includes a magnetic layer and providing a second side region that does not include a magnetic layer.

65. The method of claim 61 wherein the step of providing an asymmetrical storage disk includes providing a first side region that includes a first layer, providing a second side region that includes a second layer, and providing a body region that is positioned between the side regions, wherein the first layer and the second layer are substantially equidistant from the body region, and wherein the first layer is formed from a material having a first composition, and the second layer is formed from material having a second composition that is different from the first composition.

66. The method of claim 61 wherein the step of providing an asymmetrical storage disk includes providing a first side region and providing a second side region, the first side region having a mass that is different than a mass of the second side region.

67. The method of claim 61 wherein the step of providing an asymmetrical storage disk includes providing a first side region and providing a second side region, the first side region having a thickness that is different than a thickness of the second side region.

68. The method of claim 61 wherein the step of providing an asymmetrical storage disk includes providing a first side region and providing a second side region, the first side region having a density that is different than a density of the second side region.

69. The method of claim 61 wherein the step of providing an asymmetrical storage disk includes providing a side region that includes a stiffener that increases the rigidity of the storage disk.

70. The method of claim 61 wherein the step of providing an asymmetrical storage disk includes providing a side region that includes a stiffener that redirects fluid within the drive housing during rotation of the storage disk.

71. The method of claim 61 wherein the step of providing an asymmetrical storage disk includes the step of providing a side region that includes a damping layer that dampens vibration during rotation of the storage disk.

72. The method of claim 71 wherein the step of providing a side region includes the step of constraining the damping layer with a constraining layer.

73. The method of claim 61 wherein the step of providing an asymmetrical storage disk includes the step of providing a side region that includes a supplemental layer that balances the storage disk.

74. The method of claim 61 wherein the step of providing an asymmetrical storage disk includes the step of providing a side region that includes an adsorption layer that adsorbs impurities within the drive housing.

75. The method of claim 74 wherein the step of providing a side region includes the step of positioning a diffusion layer adjacent to the adsorption layer, the diffusion layer being adapted to filter out unwanted particles within the drive housing.

76. The method of claim 61 wherein the step of providing an asymmetric storage disk includes providing a body region and only a first side region secured to the body region.

77. A method of manufacturing an asymmetrical storage disk for a disk drive, the method comprising the steps of:

abutting a first body region against a second body region so that a portion of each body region is exposed; and

adding a layer of material onto at least one of the exposed portions of the body regions.

78. The method of claim 77 further comprising the step of separating the body regions after the material is added.

79. The method of claim 77 wherein the step of adding a layer of material includes sputter-depositing the material.

80. The method of claim 77 wherein the step of adding a layer of material includes depositing the material onto each body region.

ABSTRACT

A disk drive for storing data includes a drive housing and an asymmetrical storage disk. The storage disk includes a body region, a first side region, and an opposed second side region. The side regions are asymmetrical relative to the body region. Various structures can be, alternately or in combination, incorporated into the second side region. For example, the second side region can include one or more stiffeners that increase the rigidity of the storage disk, a plurality of projections that improve fluid flow within the disk drive, a damping layer for damping vibration of the storage disk, and/or a constraining layer that enhances the damping properties of the damping layer. In other embodiments, the second side region includes a supplemental layer that balances the storage disk, an adsorption layer that adsorbs impurities, and/or a diffusion layer that filters unwanted particles.

Exhibit B

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/056,295	01/23/2002	Erhard Schreck	3123-424 / 20011.03	9782

7590 10/09/2003

The Law Office of Steven G. Roeder
5560 Chelsea Avenue
La Jolla, CA 92037

OIPE JC29
MAR 0 6 2004
PATENT & TRADEMARK

EXAMINER	
KLIMOWICZ, WILLIAM JOSEPH	

ART UNIT	PAPER NUMBER
2652	3

DATE MAILED: 10/09/2003

RECEIVED OCT 1 3 2003

Please find below and/or attached an Office communication concerning this application or proceeding.

RECEIVED
MAR 1 5 2004
Technology Center 2600

THE LAW OFFICE OF STEVEN G. ROEDER
DOCKET #: 20011.03
DUE DATE: 11/9/03 (Sundays) → file 11/7 (Fri)
ACTION: Rest Resp
DOCKETED BY: JAD
NOTES: to JPB

IPE
MAR 0 6 2004
PATENT & TRADEMARK

Office Action Summary

Application No.	Applicant(s)	
10/056,295	SCHRECK ET AL	
Examiner	**Art Unit**	
William J. Klimowicz	2652	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-80* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *1-80* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

Election/Restrictions/Election of Speices/Sub-Speices

Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 77-80, drawn to a method of manufacturing an asymmetrical storage disk, classified in class 264, subclass 1.7, 1.33, etc.

II. Claims 1-76, drawn to an asymmetrical storage disk used in a disk drive, classified in class 360, subclass 135, 97.01, etc.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the asymmetrical disk can be made by a process such as stamping or molding an asymmetrical disk second side, etc.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

This application contains claims directed to the following patentably distinct species of the claimed invention:

Specie I. Figures 2C, 2D drawn to an asymmetrical disk having radially disposed stiffening members.

Specie II. Figure 2E drawn to an asymmetrical disk having stiffening members disposed on a second side and having layers coating the second side, such that the second side is substantially flat.

Specie III. Figures 2F-2I drawn to an asymmetrical disk having a completely flat side, with no radially disposed projecting members.

Specie IV. Figure 3A drawn to an asymmetrical disk having concentrically spaced tubular-shaped stiffening members.

Specie V. Figure 3B drawn to an asymmetrical disk having spiral-shaped stiffening member.

Specie VI. Figure 3C drawn to an asymmetrical disk having an arc-shaped stiffening members.

Specie VII. Figure 4A drawn to an asymmetrical disk having a damping layer.

Specie VIII. Figure 4B drawn to an asymmetrical disk having a damping layer and a constraining layer.

Specie IX. Figures 5A, 5B drawn to an asymmetrical disk having a plurality of projections.

Specie X. Figure 6 drawn to an asymmetrical disk having a balance modifying supplemental layer.

Specie XI. Figure 7A drawn to an asymmetrical disk having an adsorption layer.

Specie XII. Figure 7B drawn to an asymmetrical disk having an adsorption layer and a diffusion layer.

Additionally, after electing one of Species I-XII, the Applicant is further required to elect one of the following subspecies as may be pertinent to the elected Species, *supra*.

Sub-specie A. drawn to an asymmetrical disk wherein the second side of the disk has a different mass than the first side of the disk.

Sub-specie B. drawn to an asymmetrical disk wherein the second side of the disk has a different thickness than the first side of the disk.

Sub-specie C. drawn to an asymmetrical disk wherein the second side of the disk has a different density than the first side of the disk.

Applicant is required under 35 U.S.C. 121 to elect a single disclosed Species I-XII and, as may be pertinent, a single disclosed Sub-specie A-C for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable.

Applicant should further identify any claims that may be generic to the Species and/or sub-species.

Applicant is advised that a reply to this requirement must include an identification of the species that is elected consonant with this requirement, and a listing of all claims readable thereon, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 CFR 1.141. If claims are added after the election, applicant must indicate which are readable upon the elected species. MPEP § 809.02(a).

Should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

A telephone call was made to Steven G. Roeder on September 24, 2003 to request an oral election to the above restriction requirement, but did not result in an election being made.

Applicant is advised that the reply to this requirement to be complete must include an election of the invention to be examined even though the requirement be traversed (37 CFR 1.143).

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to William J. Klimowicz whose telephone number is (703) 305-3452. The examiner can normally be reached on Monday-Thursday (6:30AM-5:00PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hoa T. Nguyen can be reached on (703) 305-9687. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-4700.

William J. Klimowicz
Primary Examiner
Art Unit 2652

WJK
September 22, 2003

OIPE JC29
MAR 08 2004
PATENT & TRADEMARK OFFICE

Exhibit C

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Schreck, et al.	)
Serial No:	10/056,295	) Art Unit 2652
Filed:	January 23, 2002	)
For:	ASYMMETRIC DISK SURFACE PROPERTIES IN ONE HEAD DISK DRIVES	)
Examiner:	Klimowicz, William J.	)
Attorney Docket:	3123-424 / 20011.03	)

RESPONSE TO RESTRICTION REQUIREMENT

Mail Stop No Fees
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RECEIVED
MAR 15 2004
Technology Center 2600

Sir:

In response to the Restriction Requirement dated October 9, 2003, having a shortened statutory period for response set to expire on November 9, 2003, please amend the above-captioned patent application as provided below. This amendment and response is timely filed within the one-month deadline for response.

CERTIFICATE OF MAILING UNDER 37 CFR §1.8

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, postage prepaid, in an envelope addressed to: Mail Stop No Fees, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this the 6th day of November, 2003.

_____ JAMES P. BRODER, Attorney for Applicant--Registration No. 43,514

ELECTION

The Applicants respectfully elect with traverse the claims of Group II, Species VI, and Sub-species A, which Applicants believe comprises at least claims 1-10, 13-16, 18, 23-24, 31-41, 43-46, 48, 52-53, 59-68 and 70. Applicants further respectfully submit that at least claims 1-4, 6-7, 9, 31-33, 35-36, 38, 59-63, 65-66 and 68 are generic claims which read on each of the Species I-XII as defined by the Patent Office. Moreover, the Applicants submit that all claims are generic to each of the Sub-species.

ARGUMENT

The Applicants respectfully traverse the election requirement with respect to election of a single species and sub-species as defined by the Patent Office. The Patent Office has determined that the "application contains claims directed to the following patentably distinct species of the claimed invention: (I) Figures 2C, 2D drawn to an asymmetrical disk having radially disposed stiffening members, (II) Figure 2E drawn to an asymmetrical disk having stiffening members disposed on a secondside and having layers coating the second side, such that the second side is substantially flat, (III) Figures 2F-2I drawn to an asymmetrical disk having a completely flat side, with no radially disposed projecting members, (IV) Figure 3A drawn to an asymmetrical disk having concentrically spaced tubular-shaped stiffening members, (V) Figure 3B drawn to an asymmetrical disk having spiral-shaped stiffening members, (VI) Figure 3C drawn to an asymmetrical disk having arc-shaped stiffening members, (VII) Figure 4A drawn to an asymmetrical disk having a damping layer, (VIII) Figure 4B drawn to an asymmetrical disk having a damping layer and a constraining layer, (IX) Figure 5A, 5B drawn to an asymmetrical disk having a plurality of projections, (X) Figure 6 drawn to an asymmetrical disk having a balance modifying supplemental layer, (XI) Figure 7A drawn to an asymmetrical disk having an adsorption layer, and (XII) Figure 7B drawn to an asymmetrical disk having an adsorption layer and a diffusion layer." As set forth below, the Applicants submit that the restriction requirement is improper and should be withdrawn.

As stated in the guidelines of the MPEP for section 803, "examiners must provide reasons and/or examples to support conclusions, but need not cite documents to support the restriction requirement in most cases. Where plural inventions are capable of being

viewed as related in two ways, both applicable criteria for distinctness must be demonstrated to support a restriction requirement." (Guidelines, MPEP 803). Additionally, "for purposes of the initial requirement, a serious burden on the examiner may be *prima facie* shown if the examiner shows by appropriate explanation of separate classification, or separate status in the art, or a different field of search as defined in MPEP § 808.02." (Guidelines, MPEP 803). In the present action, the Applicants respectfully submit that the Patent Office has not adequately demonstrated reasons or examples to support its conclusions. Moreover, the Patent Office has not provided any explanation of separate classification for the separate status in the art for the Species and the Sub-species, or that a different field of search is required to examine the restricted claims of Group II together in one application.

Even where different species can be shown to be patentably distinct by the Patent Office, as set forth in MPEP 803, "there are two criteria for a proper requirement for restriction between patentably distinct inventions:

(A) The inventions must be independent; and

(B) There must be a serious burden on the examiner if restriction is required." (MPEP 803).

First, the inventions are not independent as defined by the MPEP. "The term "independent" (i.e., not dependent) means that there is no disclosed relationship between the two or more subjects disclosed, that is, they are unconnected in design, operation, or effect, for example: (1) species under a genus which species are not usable together as disclosed; ... ." (MPEP 802.01).

The Patent Office appears to have drawn a distinction between the components illustrated in Figures 2C-7B based upon the shape and/or composition of the asymmetrical storage disk. For example, the structural components included in the embodiments illustrated in Figures 2D and 3C are not completely unconnected in design, operation, or effect. These embodiments, as supported by the specification, can perform essentially similar functions. As such, separate "species" are not necessarily warranted for the embodiments illustrated in Figures 2D and 3C, as one example. Moreover, the embodiments illustrated in Figures 2C, 2E-3B and 4A-7B are not necessarily completely unconnected in design, operation, or effect to those embodiments illustrated in Figures

2D and 3C. Accordingly, the Applicants submit that examining the embodiments illustrated in Figures 2C-7B can potentially be performed together without conducting an additional search.

Based on the foregoing, the Applicants assert that the election requirement with respect to the Species and Sub-species is improper, and should be withdrawn. Consequently, the claims of Group II, comprising claims 1-76, should be examined together as required both by the Species and Sub-species designations of the Patent Office, and pursuant to MPEP 802.01 and 803.

REMARKS

Claims 1-80 are pending in the above-captioned patent application following this amendment. Claims 1-80 were subject to a restriction requirement. The Group II claims which read on Species VI and Sub-species A, comprising claims 1-10, 13-16, 18, 23-24, 31-41, 43-46, 48, 52-53, 59-68 and 70 were elected with traverse. The Applicants further respectfully submit that at least claims 1-4, 6-7, 9, 31-33, 35-36, 38, 59-63, 65-66 and 68 are generic claims which read on each of the Species I-XII as defined by the Patent Office. Further, the Applicants submit that all of the claims read on each of the Sub-species.

No new matter is believed to have been added by this amendment. Consideration of the Application is respectfully requested.

CONCLUSION

In conclusion, the Applicants respectfully assert that the Group II claims, comprising claims 1-76, should be examined together because the election requirement is improper. Alternatively, the Applicants submit that the claims of Species VI, Sub-species A, comprising claims 1-10, 13-16, 18, 23-24, 31-41, 43-46, 48, 52-53, 59-68 and 70, should be examined together, and that the claims are in condition for allowance. Accordingly, an early notice of allowance is respectfully requested. The Examiner is requested to call the undersigned at 858-456-1951 for any reason that would advance the instant application to issue.

Dated this the 6th day of November, 2003.

Respectfully submitted,

JAMES P. BRODER
Attorney for Applicants
Registration No. 43,514

THE LAW OFFICE OF STEVEN G. ROEDER
5560 Chelsea Avenue
La Jolla, California 92037
Telephone: (858) 456-1951

Exhibit D

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/056,295	01/23/2002	Erhard Schreck	3123-424 / 20011.03	9782

7590 12/02/2003

The Law Office of Steven G. Roeder
5560 Chelsea Avenue
La Jolla, CA 92037

OIPE JC26 MAR 08 2004 PATENT & TRADEMARK OFFICE

EXAMINER	
KLIMOWICZ, WILLIAM JOSEPH	
ART UNIT	PAPER NUMBER
2652	

DATE MAILED: 12/02/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

RECEIVED
MAR 15 2004
Technology Center 2600

THE LAW OFFICE OF STEVEN G. ROEDER
DOCKET #: 20011.03 / 3123-424
DUE DATE: 3 Mo. date - 3/2/04
ACTION:
DOCKETED BY: JW 03
NOTES: Non-final

OIPE JC26 MAR 08 2004 PATENT & TRADEMARK OFFICE

FORM PTO-1449 (Modified)
U.S. Dept of Commerce
Patent and Trademark Office

List Submitted in Accordance with 37 CFR § 1.98 (a)(1)

Attorney Docket:	3123-424 / 20011.03
Serial No.:	Unknown
Applicant:	Schreck et al.
Filing Date:	January 23, 2002
Group No.:	Unknown

J1050 U.S. PTO 10/056295 01/23/02

U.S. Patent Documents

Examiner Initial*		Patent Number	Issue Date	Patentee
WK	AA	5,981,018	Nov. 9, 1999	Lai et al.

Examiner: WK Date Considered: 11-24-03

* EXAMINER: Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

OIPE JC29
MAR 06 2004
PATENT & TRADEMARK OFFICE

Office Action Summary

Application No.	Applicant(s)	
10/056,295	SCHRECK ET AL.	
Examiner	**Art Unit**	
William J. Klimowicz	2652	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 November 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-80* is/are pending in the application.

4a) Of the above claim(s) *See Continuation Sheet* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7,10,14-16,18,23,24,31-36,39-41,44-46,48,52,53,59-66 and 70* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 January 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

Continuation of Disposition of Claims: Claims withdrawn from consideration are 8,9,11-13,17,19-22,25-30,37,38,42,43,47,49-51,54-58,67-69 and 71-80.

OIPE
MAR 06 2004
PATENT & TRADEMARK OFFICE

Notice of References Cited

Application/Control No.	Applicant(s)/Patent Under Reexamination	
10/056,295	SCHRECK ET AL.	
Examiner	Art Unit	Page 1 of 3
William J. Klimowicz	2652	

U.S. PATENT DOCUMENTS

		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-4,415,942	11-1983	Frosch et al.	360/135
	B	US-4,800,458	01-1989	Okita, Tsutomu	360/135
	C	US-5,476,700	12-1995	Asai et al.	428/66.6
	D	US-5,487,926	01-1996	Kuribayashi et al.	428/33
	E	US-5,538,774	07-1996	Landin et al.	428/64.1
	F	US-5,725,931	03-1998	Landin et al.	428/134
	G	US-6,055,140 A	04-2000	Marchon, Bruno J.	360/135
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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

PATENT & TRADEMARK OFFICE MAR 08 2004

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Application/Control No.	Applicant(s)/Patent Under Reexamination	
10/056,295	SCHRECK ET AL.	
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		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

OIPE JC26 MAR 06 2004 PATENT & TRADEMARK OFFICE

Notice of References Cited

Application/Control No.	Applicant(s)/Patent Under Reexamination	
10/056,295	SCHRECK ET AL.	
Examiner	Art Unit	Page 3 of 3
William J. Klimowicz	2652	

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-			
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	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

OIPE JC20 MAR 08 2004 PATENT & TRADEMARK OFFICE

DETAILED ACTION

Election/Restrictions

Applicants' election with traverse of Group II, Species VI, and Sub-species A (which Applicants allege to read on claims 1-10, 13-16, 18, 23-24, 31-41, 43-46, 48, 52, 53, 59-68 and 70) in Paper No. 4 (filed November 10, 2003) is acknowledged. The traversal is on the ground(s) that the Grouped inventions and Species, Sub-species are not independent and distinct, and that a search for additional inventions would not impose a serious burden upon the Examiner.

This is not found persuasive because the Examiner maintains that the restriction is proper and that a search for the plethora of distinct inventions would indeed impose a grave and serious burden upon the Examiner, as evidenced by, *inter alia*, the number of distinct inventions.

Moreover, the Examiner maintains all that is required to show a restriction is proper, in addition to being a serious burden to the Examiner, is that the inventions be independent ***or*** distinct, not independent ***and*** distinct as Applicants apparently would have the Examiner believe.

More specifically, as set forth in MPEP § 803:

> Under the statute an application may properly be required to be restricted to one of two or more claimed inventions only if they are able to support separate patents and they are either independent (MPEP § 806.04 - § 806.04(i)) ***or*** distinct (MPEP § 806.05 - § 806.05(i)). [Emphasis in bold italics added].

Moreover as set forth in MPEP § 802.01, the meaning of independent "and" distinct within the context of Patent Office restriction policy and practice is articulated as follows:

> 35 U.S.C. 121 quoted in the preceding section states that the Commissioner may require restriction if two or more "independent and distinct"

> inventions are claimed in one application. In 37 CFR 1.141, the statement is made that two or more "independent and distinct inventions" may not be claimed in one application.
>
> This raises the question of the subjects as between which the Commissioner may require restriction. This, in turn, depends on the construction of the expression "independent and distinct" inventions.
>
> "Independent", of course, means not dependent. If "distinct" means the same thing, then its use in the statute and in the rule is redundant. If "distinct" means something different, then the question arises as to what the difference in meaning between these two words may be. The hearings before the committees of Congress considering the codification of the patent laws indicate that 35 U.S.C. 121: "enacts as law existing practice with respect to division, at the same time introducing a number of changes."
>
> The report on the hearings does not mention as a change that is introduced, the subjects between which the Commissioner may properly require division.
>
> The term "independent" as already pointed out, means not dependent. A large number of subjects between which, prior to the 1952 Act, division had been proper, are dependent subjects, such as, for example, combination and a subcombination thereof; as process and apparatus used in the practice of the process; as composition and the process in which the composition is used; as process and the product made by such process, etc. If section 121 of the 1952 Act were intended to direct the Commissioner never to approve division between dependent inventions, the word "independent" would clearly have been used alone. If the Commissioner has authority or discretion to restrict independent inventions only, then restriction would be improper as between dependent inventions, e.g., the examples used for purpose of illustration above. Such was clearly not the intent of Congress. Nothing in the language of the statute and nothing in the hearings of the committees indicate any intent to change the substantive law on this subject. On the contrary, joinder of the term "distinct" with the term "independent", indicates lack of such intent. The law has long been established that dependent inventions (frequently termed related inventions) such as used for illustration above may be properly divided if they are, in fact, "distinct" inventions, even though dependent.

Thus, clearly, the restriction is proper if the Examiner shows that the invention are distinct or independent, but not necessarily both independent and distinct.

Additionally, it is noted that the Applicants did not traverse on the ground that the species and/or sub-species are not patentably distinct. If the Applicants were to traverse on the ground that the species are not patentably distinct, the Applicants should submit evidence or identify

such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. If the Applicants were to include such a statement, the election requirement would be withdrawn. In either instance, however, if the Examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. § 103 of the other invention.

Moreover, it is noted that claims 8, 9, 13, 37, 38, 43, 67 and 68, which Applicants have indicated as being readable on the elected invention are in fact directed to a non-elected invention. Claims 8, 37 and 67 are directed to non-elected Sub-specie B, and claims 9, 38 and 68 are directed to non-elected Sub-specie C. Additionally, claims 13 and 43 are also directed to a non-elected Species IV (see Restriction Requirement, Paper No. 3, mailed October 9, 2003).

The restriction requirement is still deemed proper and is therefore made FINAL.

Thus, claims 8, 9, 11-13, 17, 19-22, 25-30, 37, 38, 42, 43, 47, 49-51, 54-58, 67-69 and 71-80 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in Paper No. 4.

Claims 1-7, 10, 14-16, 18, 23, 24, 31-36, 39-41, 44-46, 48, 52, 53, 59-66 and 70 have been examined on the merits, *infra*.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on

sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 31, 32, 34-36, 39, 40, 44-46, 48, 52 and 59 are rejected under 35 U.S.C. 102(b) as being anticipated by IBM Technical Disclosure Bulletin "Flexible Magnetic Disk Stabilizer," November 1977, Vol. No. 20, Issue No. 6, pages 2378-2379, Cross Reference 0018-8689-20-6-2378, referred to hereinafter as IBM TDB '2378.

As broadly set forth in claim 31 (and also claims 1 and 61, rejected, *infra*), (IBM TBD '2378) discloses a storage disk (e.g., integrated disk structure 4, 1 and 5) for a disk drive, the storage disk (4, 1, 5) comprising: a body region (1); a first side region (4) secured to the body region (1); and a substantially opposed second side region (5) secured to the body region (1); wherein the side regions are asymmetrical relative to the body region (1).

Note that at least independent claims 1, 31 and 61, are broad enough to read on a conventional disk drive having a single sided magnetic storage surface (having magnetic layer on one side and a substrate on the other with no magnetic layer). The Examiner, however, has at this time, cited document (IBM TBD '2378). The Examiner suggests amending the overly broad claims so as to obviate conventionally known structure so as to expedite prosecution on the merits to preclude any future claim rejections on such known prior art, which may occur, based on any potential amendments and/or arguments.

As per claims 32 (and claims 3 and 63, rejected *infra*), wherein the first side region (4) is adapted to store data, and the second side region (5) is not adapted to store data.

As per claims 34 (and claims 5 and 64, rejected *infra*), wherein the first side region (4) includes a magnetic layer, and the second side region (5) does not include a magnetic layer.

As per claim 35 (and claims 6 and 65, rejected *infra*), wherein the first side region (4) includes a first layer (magnetic material layer of (4)) and the second side region (5) includes a

second layer (layer of fan blade (6)), the first layer and the second layer being "substantially" equidistant from the body region (1) - see Figures of (IBM TBD '2378), wherein the first layer (4) is formed from a material having a first composition, and the second layer is formed from material having a second composition that is different from the first composition (e.g. the composition of layer (4) is such that magnetic information can be stored and retrieved therefrom while the composition of (5) is not adapted for such storage of data - it includes a fan blade (6)).

As per claims 36 (and claims 7 and 66, rejected *infra*), as is evident from the Figures, the first side region (4) has a mass that is different than a mass of the second side region (5) - the layer (4) is thin and flexible, while the material (5) including blades (6) is rigid and much larger.

As per claims 39 (and claims 10 and 70, rejected *infra*), wherein the second side region (5) includes a stiffener (including blades (6)) that increases the rigidity of the storage disk (4, 1, 5).

As per claims 44 (and claims 14 and 70 rejected *infra*), wherein the stiffener (6) redirects fluid within a drive housing during rotation of the storage disk (4, 1, 5).

As per claims 45 (and claim 15, rejected *infra*), wherein the stiffener (6) is substantially arc-shaped - see Figures of (IBM TBD '2378).

As per claims 46 (and claim 16, rejected *infra*), wherein the storage disk (4, 1, 5) includes a plurality of stiffeners (6) that increase the rigidity of the storage disk (4, 1, 5).

As per claims 40, 48 (and claim 18, rejected *infra*), wherein the second side region (5) includes an outer flat section (5) and wherein each of the stiffeners (6) is raised above the outer flat region (5).

As per claims 52 (and claim 23, rejected *infra*), wherein the second side region (5)

includes an outer flat section (5) and a plurality of projections (6) that extend above the outer flat section (5).

As per claim 59, wherein the first side region (4) has a first shape and the second side region (5) has a second shape, and wherein the first shape is different than the second shape.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-7, 10, 14-16, 18, 23, 24, 33, 41, 53, 60-66 and 70 are rejected under 35 U.S.C. 103(a) as being unpatentable over (IBM TBD '2378).

See the description of (IBM TBD '2378), *supra*.

As per claims 2 and 62, wherein the storage disk (4, 1, 5) includes a first side region (4), a spaced apart second side region (5) and a body region (1) that is positioned between the side regions, the side regions being asymmetrical relative to the body region (see enclosed Figures of (IBM TBD '2378)).

With regard to claims 1, 60 and 61, although (IBM TBD '2378) does not expressly disclose a disk drive inclusive of a housing (and method of forming such a disk drive) so as to enable spinning of the disk, Official notice is taken that disk drive housings including elements to enable disk rotation (e.g., a disk drive spindle motor) are notoriously old and well known and ubiquitous in the art; such Officially noticed fact being capable of instant and unquestionable

demonstration as being well-known.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the disk, as taught by (IBM TBD '2378), within a conventional and ubiquitous disk drive.

The rationale is as follows: one of ordinary skill in the art would have been motivated to provide the disk, as taught by (IBM TBD '2378), within a conventional and ubiquitous disk drive in order to utilize the advantages of the disk of (IBM TBD '2378) (e.g., an inexpensive disk within a conventional disk drive) within its intended operating environment.

Additionally, as per claims 4 and 33, the second side region (5) does not include any servo sectors (since it is not adapted to store data of any kind). However, (IBM TBD '2378) remains silent with respect to wherein the first side region includes a plurality of servo sectors on its data side.

Official notice is taken that servo sectors on magnetic information disk media of the type disclosed by (IBM TBD '2378), are notoriously old and well known and ubiquitous in the art; such Officially noticed fact being capable of instant and unquestionable demonstration as being well-known.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the disk, as taught by (IBM TBD '2378), with a servo sector within data-side (4) as is conventional and ubiquitous.

The rationale is as follows: one of ordinary skill in the art would have been motivated to provide the disk, as taught by (IBM TBD '2378), with a servo sector within data-side (4) as is conventional and ubiquitous in order to accurately position the head (7) of (IBM TBD '2378) on

the intended data track to record/reproduce information in an accurate manner, as is well known, established and appreciated in the art.

As per claims 24, 41 and 53, although (IBM TBD '2378) remains silent with respect to the particular dimensions of the disk, including wherein at least one of the projections (6) is raised above the outer flat region (5) by at least approximately 0.001 millimeters (claim 24, 41, 53), it is notoriously old and well known in the disk and disk drive art to routinely modify a disk structure in the course of routine optimization/ experimentation and thereby obtain various standard optimized relationships including those set forth in claims 24, 41 and 53.

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to have had the disk (4, 1, 5) of (IBM TBD '2378) have at least one projection (6) being a minimum of 0.001 millimeter above the flat surface (5) (as per claims 24, 41 and 53).

The rationale is as follows: one of ordinary skill in the art would have been motivated to have had the disk (4, 1, 5) of (IBM TBD '2378) have at least one projection (6) being a minimum of 0.001 millimeter above the flat surface (5) (as per claims 24, 41 and 53) in order to generate the desired sufficient vacuum as required by the disk of (IBM TBD '2378).

Moreover, absent a showing of criticality (i.e., unobvious or unexpected results), the relationships set forth in claims 24, 41 and 53 are considered to be within the level of ordinary skill in the art.

Additionally, the law is replete with cases in which when the mere difference between the claimed invention and the prior art is some range, variable or other dimensional limitation within the claims, patentability cannot be found.

It furthermore has been held in such a situation, the Applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Moreover, the instant disclosure does not set forth evidence ascribing unexpected results due to the claimed dimensions. See *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338 (Fed. Cir. 1984), which held that the dimensional limitations failed to point out a feature which performed and operated any differently from the prior art.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to William J. Klimowicz whose telephone number is (703) 305-3452. The examiner can normally be reached on Monday-Thursday (6:30AM-5:00PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hoa T. Nguyen can be reached on (703) 305-9687. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9314.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-4700.

William J. Klimowicz
Primary Examiner
Art Unit 2652

WJK
November 24, 2003

OIPE JC26
MAR 06 2004
PATENT & TRADEMARK OFFICE

Exhibit E

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Schreck, et al.	)
Serial No:	10/056,295	) Art Unit 2652
Filed:	January 23, 2002	)
For:	ASYMMETRIC DISK SURFACE PROPERTIES IN ONE HEAD DISK DRIVES	)
Examiner:	Klimowicz, William J.	)
Attorney Docket:	3123-424 / 20011.03	)

AMENDMENT AND RESPONSE TO OFFICE ACTION

RECEIVED
MAR 15 2004
Technology Center 2600

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated December 2, 2003, having a shortened statutory period for response set to expire on March 2, 2004, please amend the above-captioned patent application as provided below. This amendment and response is timely filed within the three-month deadline for response.

CERTIFICATE OF MAILING UNDER 37 CFR §1.8

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, postage prepaid, in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this the 2nd day of March, 2004.

_____ JAMES P. BRODER, Attorney for Applicant--Registration No. 43,514

Status of All Claims in the Application:

1. (Canceled)

2. (Currently Amended) The disk drive of claim [[1]] 81 wherein the storage disk includes a first side region[[,]] and a spaced apart second side region, ~~and a~~ the body region ~~that is~~ being positioned between the side regions, the side regions being asymmetrical relative to the body region.

3. (Canceled)

4. (Original) The disk drive of claim 2 wherein the first side region includes a plurality of servo sectors, and the second side region does not include any servo sectors.

5. (Currently Amended) The disk drive of claim 2 wherein only one of the side regions ~~the first side region~~ includes [[a]] ~~magnetic layer, and the second side region does not include a~~ the data storage layer.

6. (Original) The disk drive of claim 2 wherein the first side region includes a first layer and the second side region includes a second layer, the first layer and the second layer being substantially equidistant from the body region, wherein the first layer is formed from a material having a first composition, and the second layer is formed from material having a second composition that is different from the first composition.

7. (Original) The disk drive of claim 2 wherein the first side region has a mass that is different than a mass of the second side region.

8. (Withdrawn) The disk drive of claim 2 wherein the first side region has a thickness that is different than a thickness of the second side region.

9. (Withdrawn) The disk drive of claim 2 wherein the first side region has a density that is different than a density of the second side region.

10. (Original) The disk drive of claim 2 wherein the second side region includes a stiffener that increases the rigidity of the storage disk.

11. (Withdrawn) The disk drive of claim 10 wherein the stiffener extends substantially radially from near an inner diameter of the storage disk.

12. (Withdrawn) The disk drive of claim 11 wherein the second side region includes an outer flat section and the stiffener is raised at least approximately 0.001 millimeters above the outer flat section.

13. (Canceled)

14. (Original) The disk drive of claim 10 wherein the stiffener redirects fluid within the drive housing during rotation of the storage disk.

15. (Original) The disk drive of claim 10 wherein the stiffener is substantially arc-shaped.

16. (Original) The disk drive of claim 2 wherein the storage disk includes a plurality of stiffeners that increase the rigidity of the storage disk.

17. (Withdrawn) The disk drive of claim 16 wherein the second side region includes an outer flat section, and wherein at least one of the stiffeners is positioned below the outer flat section.

18. (Original) The disk drive of claim 16 wherein the second side region includes an outer flat section and wherein each of the stiffeners is raised above the outer flat region.

19. (Withdrawn) The disk drive of claim 2 wherein the second side region includes a damping layer that dampens vibration of the storage disk during rotation, and wherein the first side region does not include a damping layer.

20. (Withdrawn) The disk drive of claim 19 wherein the damping layer includes a viscoelastic material.

21. (Withdrawn) The disk drive of claim 19 wherein the damping layer includes a material that is applied with an adhesive.

22. (Withdrawn) The disk drive of claim 19 wherein the second side region includes a constraining layer that constrains the damping layer, wherein the damping layer is positioned between the constraining layer and the body region.

23. (Original) The disk drive of claim 2 wherein the second side region includes an outer flat section and a plurality of projections that extend above the outer flat section.

24. (Original) The disk drive of claim 23 wherein at least one of the projections is raised above the outer flat region by at least approximately 0.001 millimeters.

25. (Withdrawn) The disk drive of claim 2 wherein the second side region includes a supplemental layer that balances the storage disk.

26. (Withdrawn) The disk drive of claim 25 wherein the supplemental layer has a non-uniform thickness.

27. (Withdrawn) The disk drive of claim 2 wherein the second side region includes an adsorption layer that adsorbs impurities within the drive housing.

28. (Withdrawn) The disk drive of claim 27 wherein the adsorption layer includes a chemical adsorbent.

29. (Withdrawn) The disk drive of claim 27 wherein the second side region includes a diffusion layer that is positioned adjacent to the adsorption layer, the diffusion layer being adapted to filter out unwanted particles within the drive housing.

30. (Withdrawn) The disk drive of claim 1 wherein the storage disk includes a body region having a first body side and an opposed second body side, wherein one of the body sides is exposed.

31. (Currently Amended) A storage disk for a disk drive, the storage disk comprising:

a body region;

a first side region secured to the body region; and

a substantially opposed second side region secured to the body region;

wherein only one of the side regions includes a data storage layer, and wherein the body region and the side regions are formed as a unitary structure, and the side regions are asymmetrical relative to the body region.

32. (Canceled)

33. (Original) The storage disk of claim 31 wherein the first side region includes a plurality of servo sectors, and the second side region does not include any servo sectors.

34. (Canceled)

35. (Original) The storage disk of claim 31 wherein the first side region includes a first layer and the second side region includes a second layer, the first layer

and the second layer being substantially equidistant from the body region, wherein the first layer is formed from a material having a first composition, and the second layer is formed from material having a second composition that is different from the first composition.

36. (Original) The storage disk of claim 31 wherein the first side region has a mass that is different than a mass of the second side region.

37. (Withdrawn) The storage disk of claim 31 wherein the first side region has a thickness that is different than a thickness of the second side region.

38. (Withdrawn) The storage disk of claim 31 wherein the first side region has a density that is different than a density of the second side region.

39. (Original) The storage disk of claim 31 wherein the second side region includes a stiffener that increases the rigidity of the storage disk.

40. (Original) The storage disk of claim 39 wherein the second side region includes an outer flat section, and wherein the stiffener extends away from the outer flat section.

41. (Original) The storage disk of claim 40 wherein the stiffener extends away from the outer flat section at least approximately 0.001 millimeters.

42. (Withdrawn) The storage disk of claim 39 wherein the stiffener extends substantially radially from an inner diameter of the second side region.

43. (Withdrawn) The storage disk of claim 39 wherein the stiffener is tubular shaped.

44. (Original) The storage disk of claim 39 wherein the stiffener redirects fluid

during rotation of the storage disk.

45. (Original) The storage disk of claim 39 wherein the stiffener is substantially arc-shaped.

46. (Original) The storage disk of claim 31 wherein the second side region includes a plurality of spaced apart stiffeners that increase the rigidity of the second side region.

47. (Withdrawn) The storage disk of claim 46 wherein the second side region includes an outer flat section, and wherein at least one of the stiffeners is positioned below the outer flat section.

48. (Original) The storage disk of claim 46 wherein the second side region includes an outer flat section and each of the stiffeners extends away from the outer flat section.

49. (Withdrawn) The storage disk of claim 31 wherein the second side region includes a damping layer that dampens vibration of the storage disk, and wherein the first side region does not include a damping layer.

50. (Withdrawn) The storage disk of claim 49 wherein the damping layer includes a viscoelastic material.

51. (Withdrawn) The storage disk of claim 49 wherein the second side region includes a constraining layer that constrains the damping layer, wherein the damping layer is positioned between the constraining layer and the body region.

52. (Original) The storage disk of claim 31 wherein the second side region includes an outer flat region and a plurality of projections that extend away from the outer flat region.

53. (Original) The storage disk of claim 52 wherein at least one of the projections extends away from the outer flat region at least approximately 0.001 millimeters.

54. (Withdrawn) The storage disk of claim 31 wherein the second side region includes a supplemental layer that balances the storage disk during rotation of the storage disk.

55. (Withdrawn) The storage disk of claim 54 wherein the supplemental layer has a non-uniform thickness.

56. (Withdrawn) The storage disk of claim 31 wherein the second side region includes an adsorption layer that adsorbs impurities.

57. (Withdrawn) The storage disk of claim 56 wherein the adsorption layer includes a chemical adsorbent.

58. (Withdrawn) The storage disk of claim 56 wherein the second side region includes a diffusion layer that is positioned adjacent to the adsorption layer, the diffusion layer being adapted to filter out unwanted particles.

59. (Original) The storage disk of claim 31 wherein the first side region has a first shape and the second side region has a second shape, and wherein the first shape is different than the second shape.

60. (Original) A disk drive including a drive housing and the storage disk of claim 31.

61-80. (Canceled)

81. (New) A disk drive comprising:

a drive housing; and

an asymmetrical storage disk that is rotatably coupled to the drive housing, the storage disk having a body region and only one data storage layer that is fixedly coupled to the body region during non-rotation of the storage disk.

82. (New) The disk drive of claim 2 wherein the side regions are not spaced apart from the body region.

83. (New) The disk drive of claim 7 wherein the mass of the second side region differs from the mass of the first side region by at least approximately 0.0001 percent.

84. (New) The disk drive of claim 7 wherein the mass of the second side region differs from the mass of the first side region by at least approximately 0.01 percent.

85. (New) The disk drive of claim 10 wherein the storage disk includes an inner diameter and an outer diameter, and wherein the stiffener extends substantially between the inner diameter and the outer diameter.

86. (New) The disk drive of claim 10 wherein the stiffener at least partly forms an outer ridged section that cantilevers in a direction away from the body region.

87. (New) The disk drive of claim 86 wherein the outer ridged section has a top surface that is fully exposed within the drive housing.

88. (New) The disk drive of claim 86 wherein the second side region has an outer flat section, and wherein the outer ridged section extends at least approximately 10 microns away from the outer flat section.

89. (New) The disk drive of claim 16 wherein the plurality of stiffeners are non-concentric.

90. (New) The storage disk of claim 31 wherein the side regions are not spaced apart from the body region.

91. (New) The disk drive of claim 36 wherein the mass of the second side region differs from the mass of the first side region by at least approximately 0.0001 percent.

92. (New) The disk drive of claim 36 wherein the mass of the second side region differs from the mass of the first side region by at least approximately 0.01 percent.

93. (New) The storage disk of claim 39 wherein the storage disk includes an inner diameter and an outer diameter, and wherein the stiffener extends substantially between the inner diameter and the outer diameter.

94. (New) The storage disk of claim 39 wherein the stiffener at least partly forms an outer ridged section that cantilevers in a direction away from the body region.

95. (New) The storage disk of claim 94 wherein the outer ridged section has a top surface that is fully exposed within the drive housing.

96. (New) The storage disk of claim 94 wherein the second side region has an outer flat section, and wherein the outer ridged section extends at least approximately 10 microns away from the outer flat section.

97. (New) The storage disk of claim 46 wherein the plurality of stiffeners are non-concentric.

98. (New) A method for making a disk drive, the method comprising the steps of:

providing a drive housing; and

rotatably coupling a storage disk to the drive housing, the storage disk having a first side region and a second side region that are fixedly coupled to a body region so that the side regions are not spaced apart from the body region and only one of the side regions includes a data storage layer.

99. (New) The method of claim 98 wherein the step of rotatably coupling includes positioning the body region between the first side region and the second side region.

100. (New) The method of claim 98 wherein the step of rotatably coupling includes positioning a first layer within the first side region and a second layer within the second side region so that the first layer and the second layer are substantially equidistant from the body region, forming the first layer from a first material, and forming the second layer from a second material that is different from the first material.

101. (New) The method of claim 98 wherein the step of rotatably coupling includes providing the first side region having a mass that is different than a mass of the second side region.

102. (New) The method of claim 98 wherein the step of rotatably coupling includes positioning a raised stiffener within the second side region.

103. (New) The method of claim 102 wherein the step of positioning a raised stiffener includes positioning the stiffener to cantilever in a direction away from the body region.

104. (New) The method of claim 102 wherein the raised stiffener is substantially arc-shaped.

105. (New) The method of claim 102 wherein the raised stiffener has an outer ridged section that extends at least approximately 10 microns away from an outer flat section of the second side region.

106. (New) A disk drive comprising:

a drive housing; and

an asymmetrical storage disk that is rotatably coupled to the drive housing, the storage disk having a body region, a first side region that includes a data storage surface, and a second side region that includes an arc-shaped stiffener that cantilevers in a direction away from the body region, the stiffener being positioned opposite the data storage surface of the first side region.

107. (New) The disk drive of claim 106 wherein the stiffener extends from near an inner diameter to an outer diameter of the storage disk.

In the Specification:

Please amend the paragraph of the specification beginning at page 11, line 1, as follows:

[[Is]] It should be noted that in Figure 2D, the number and thicknesses of first layers of the first side region 44 are substantially the same as the number and thicknesses of the second layers of the second side region [[46]] 62. However, the number of first layers in the first side region 44 can be greater or less than the number of second layers in the second side region [[46]] 62. For example, because the second side ~~surface 46~~ region 62 does not need to be adapted to store data, the second side region [[46]] 62 can be designed to not include the second magnetic layer 84. Therefore, one or more of the second layers of the second side region 62 shown in Figure 2D can be omitted, or substituted with a different material, with no detrimental effects to operation of the disk drive 10.

Please amend the paragraph of the specification beginning at page 13, line 17, as follows:

Figure 3A illustrates a perspective view of another embodiment of an asymmetrical storage disk 318A. In this embodiment, the second side region 362A ~~including~~ includes a plurality of spaced apart, substantially concentric, tubular shaped stiffeners 356A, each having a different ~~radaii~~ radii. In this embodiment, the stiffeners 356A are centered about a rotational axis 394A of the storage disk 318A. Although Figure 3A illustrates that the second side region 362A includes five concentric stiffeners 356A, any number of concentric stiffeners 356A can be used.

REMARKS

Claims 2, 4-12, 14-31, 33, 35-60 and 81-107 are pending in the above-captioned patent application following this amendment. The Applicants have amended the specification to correct obvious typographical errors. Claims 1, 7-10, 14-16, 18, 23, 24, 31-36, 39-41, 44-46, 48, 52, 53, 59-66 and 70 were rejected. Claims 8, 9, 11-13, 17, 19-22, 25-30, 37, 38, 42, 43, 47, 49-51, 54-58, 67-69 and 71-80 have been withdrawn from consideration by the Patent Office. The restriction requirement and subsequent withdrawal of claims from consideration is the subject of a Petition for Withdrawal of the Restriction Requirement which has been filed concurrently herewith. Claims 2, 5 and 31 were amended, claims 1, 3, 13, 32, 34 and 61-80 have been canceled without prejudice and new claims 81-107 have been added by this amendment for the purpose of expediting the patent application process in a manner consistent with the goals of the Patent Office pursuant to 65 Fed. Reg. 54603 (September 8, 2000), even though the applicants believe that the previously pending claims were allowable.

Support for the amendments to the claims and the new claims can be found throughout the originally filed application, including the originally filed claims, the drawings and the specification. More specifically, support for new claims 81-107 can be found at least in claims 1, 6, 10-12, 16, 18, 34, 35, 39-42, 46, 48 and 59-70, in Figures 2A-2F, 3A-3C, 4A-4B, 5A-5B, 6 and 7A-7B, and in the specification at page 8, line 15 through page 14, line 19, at page 16, line 15 through page 17, line 27, and at page 19, lines 3-15.

No new matter is believed to have been added by this amendment. Consideration of the Application is respectfully requested.

Rejections Under 35 U.S.C. § 102

Claims 31, 32, 34-36, 39, 40, 44-46, 48, 52 and 59 are rejected under 35 U.S.C. § 102(b) as being anticipated by IBM Technical Disclosure Bulletin "Flexible Magnetic Disk Stabilizer," November 1977, Vol. No. 20, Issue No. 6, pages 2378-2379, Cross Reference 0018-8689-20-6-2378 ("IBM TDB '2378"). Claims 32 and 34 have been canceled without prejudice by this amendment. Therefore the rejection of claims 32 and 34 is believed to be moot. Further, claim 31 has been amended, and as provided below, amended claim 31 includes features that are not taught or suggested by IBM

TDB '2378.

IBM TDB '2378 is directed toward a base plate 1 and a separate flexible disk 4 that is removably positioned on the base plate 1. The flexible disk 4 and the base plate 1 are not formed as a unitary structure. The base plate 1 is secured to a fan plate 5, and is made from porous material having air channels used to hold the flexible disk 4 down on a top surface 2 of the base plate 1 during rotation of the base plate 1 and the fan plate 5. Rotation of the fan plate 5 causes air to move outwardly from the gap between the base plate 1 and the fan plate 5 to create a vacuum that holds the flexible disk 4 down. (See the Figures). Therefore, rotation of the base plate 1 and fan plate 5 cooperate to hold the flexible disk to the base plate 1 during rotation, e.g. operation of the drive. Moreover, without the gap between the base plate 1 and the fan plate 5, no air flow would occur to generate the vacuum to hold the flexible disk 4 down.

In contrast to IBM TDB '2378, amended claim 31 is directed toward a storage disk for a disk drive that requires "a body region; a first side region secured to the body region; and a substantially opposed second side region secured to the body region; wherein only one of the side regions includes a data storage layer, and wherein the body region and the side regions are formed as a unitary structure, and the side regions are asymmetrical relative to the body region." These features are not taught or suggested by IBM TDB '2378. Therefore, IBM TDB '2378 does not support a rejection of amended claim 31. Further, because claims 35, 36, 39, 40, 44-46, 48, 52 and 59 depend directly or indirectly from claim 31, IBM TDB '2378 likewise does not support a rejection of these claims. In addition, allowance of any generic claims results in examination of any previously withdrawn claims which depend directly or indirectly from from such generic claim(s).

Rejections Under 35 U.S.C. § 103

Claims 1-7, 10, 14-16, 18, 23, 24, 33, 41, 53, 60-66 and 70 are rejected under 35 U.S.C. § 103 are being unpatentable over IBM TDB '2378. Claims 1, 3, 60-66 and 70 have been canceled without prejudice by this amendment. Thus, the rejection of these claims is believed to be moot.

Further, claims 2, 4-7, 10, 14-16, 18, 23 and 24 have been directly or indirectly amended to depend from new independent claim 81. As set forth below, the features of claim 81 are believed not to be taught or suggested by the cited references. Therefore, the features of dependent claims 2, 4-7, 10, 14-16, 18, 23 and 24 are likewise believed not to be taught or suggested by IBM TDB '2378.

Moreover, claims 33, 41 and 53 depend directly or indirectly from amended independent claim 31. As provided above, the features of amended claim 31 are not taught or suggested by the cited references. Therefore, the features of claims 33, 41 and 53 are also not taught or suggested by IBM TDB '2378. In addition, allowance of any generic claims results in examination of any previously withdrawn claims which depend directly or indirectly from from such generic claim(s).

New Claims

New claims 81-107 have been added by this amendment. New claims 81-107 are of a slightly different scope than the previously pending claims. However, IBM TDB '2378 does not teach or suggest the features of new claims 81-107.

For example, new claim 81 is directed toward a disk drive that requires "a drive housing; and an asymmetrical storage disk that is rotatably coupled to the drive housing, the storage disk having a body region and only one data storage layer that is fixedly coupled to the body region during non-rotation of the storage disk." These features are not taught or suggested by IBM TDB '2378. Therefore, claim 81 should be allowed. Because claims 82-89 depend directly or indirectly from claim 81, they should also be allowed.

As provided above, new claims 90-97 depend directly or indirectly from amended claim 31, which has features that are not taught or suggested by IBM TDB '2378. Therefore, claims 90-97 likewise have features that are not taught or suggested by IBM TDB '2378.

New claim 98 is directed toward a method for making a disk drive that requires the steps of "providing a drive housing; and rotatably coupling the storage disk to the drive housing, the storage disk having a first side region and a second side region that are fixedly coupled to a body region so that the side regions are not spaced apart from

the body region and only one of the side regions includes a data storage layer." These steps are not taught or suggested by IBM TDB '2378. Thus, claim 98 should be allowed. Because claims 99-105 depend directly or indirectly from claim 98, they should also be allowed.

New claim 106 requires "a drive housing; and an asymmetrical storage disk that is rotatably coupled to the drive housing, the storage disk having a body region, a first side region and a second side region, wherein only one of the side regions includes an arc-shaped stiffener cantilevers in a direction away from the body region, the stiffener extending from near an inner diameter to near an outer diameter of the storage disk." These features are not taught or suggested by IBM TDB '2378. Thus claim 106 should be allowed. Because claim 107 depends from claim 106, it should also be allowed.

Conclusion

In conclusion, Applicants respectfully assert that claims 2, 4-12, 14-31, 33, 35-60 and 81-107 are patentable for the reasons set forth above, and that the application is now in a condition for allowance. Accordingly, an early notice of allowance is respectfully requested. In addition, allowance of any generic claims results in examination of any previously withdrawn claims which depend directly or indirectly from from such generic claim(s). The Examiner is requested to call the undersigned at 858-672-0454 for any reason that would advance the instant application to issue.

Dated this 2nd day of March, 2004.

Respectfully submitted,

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